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The WATERPROOFING HANDBOOK

Genfire Steel Company

YOUNGSTOWN, OHIO

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THE
WATERPROOFING
HANDBOOK

GUIDE

EIGHTH EDITION

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GENFIRE STEEL CO.
YOUNGSTOWN, OHIO

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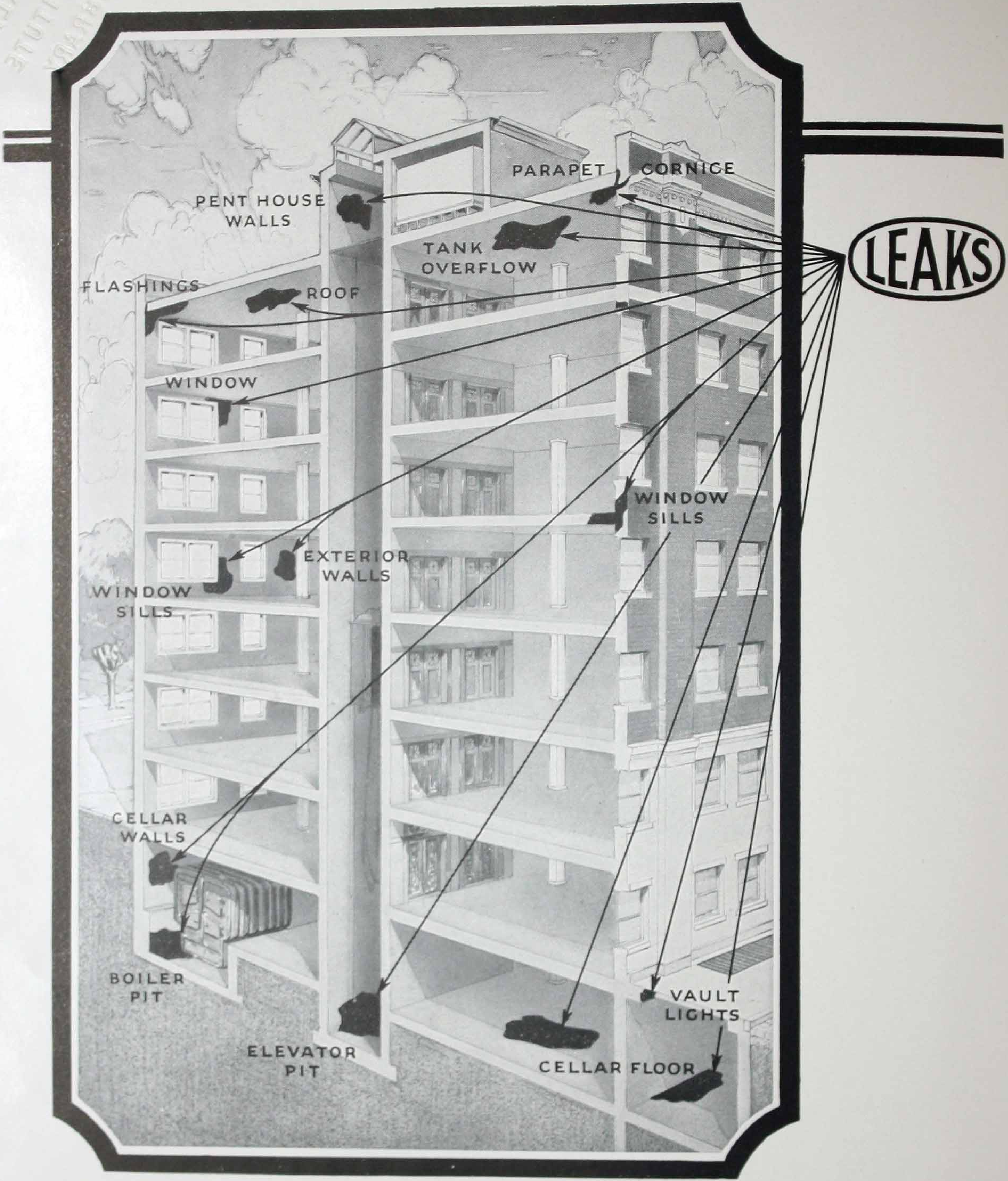

Diagram showing the hazards of water: Every spot represents a leak and every leak is a mark of danger:

FOREWORD

GUIDE

Engineers, Architects, Contractors and men who now or manage structures of almost any kind will find the following pages filled with interesting information regarding effective and economical methods for waterproofing concrete and all forms of masonry both above and below grade: for preserving decorative effects, exterior and interior; and for protecting finished surfaces—whether wood, plaster, concrete or metal—against water, wear, stains, and other destructive agencies.

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Waterproofing Methods and Materials

Introduction

DURING the past 30 years, since the first introduction of waterproofing products and methods in structures subjected to heavy or constant water pressure, this subject has received a great deal of attention, until now waterproofing is regarded as a prime necessity in such work.

There are other conditions, however, where water causes great damage, and its destructive action results in untold losses because of the insidious manner in which it attacks all unprotected building materials.

Water, even when only intermittently present in small quantities, exerts a slow but sure destructive action upon practically all building materials, for it corrodes metal, disrupts brick, stone, concrete and all work in which cement is used, and causes the decay of wood, especially where these materials are exposed to the air.

Nearly everything in nature contains a varying percentage of water, and is more or less porous. It is true that with certain building materials and products, such as brick and tile, the natural water content is driven off through kiln burning, but the pores through which this water evaporated remain and will readily admit moisture.

The material may absorb moisture from several sources. All air contains some water, and when the atmosphere contains more than the material, the material absorbs a part. Rain or ground seepage add water. Furthermore, the average soil has a natural water content of about 2% of its volume, a part of which may be drawn through the walls to the interior of the construction because of the fact that warmth attracts moisture.

The destructive action of water is due to several reasons:—

1. Water, either from the soil or the air, generally holds salts, alkalies and other chemicals and impurities in suspension. Many of these cause the formation of sulphuric acid.

2. A surface wetted with water expands, due to the forcing apart of its constituent atoms by the squeezing in of the incompressible molecules of water. When the water evaporates or is withdrawn, the surface contracts, but never to its former size. Alternate wetting and drying result in the gradually increasing enlargement of the surface until the stresses thereby set up are greater than the bond or adhesion between its component atoms, resulting in cracks and spalls. The rapid destruction of concrete in proximity to large bodies of water is due mostly to alternate saturation with and drying out of moisture from the air. In the case of sea water or sea air, disintegration is greatly hastened by the generation of magnesium hydrate and calcium sulphate which are formed by the reaction of the sodium and magnesium sulphates contained in the sea air and water with the calcium hydrate of cement. These chemicals are expansive in their formation, thereby forcing the grains of cement apart, causing cracks, and ultimately, disintegration.

3. Water, when freezing, expands with great pressure, and when it is in cracks or pores of materials, causes considerable damage.

4. Dust, dirt, soot, etc., upon any surface are carried deeply into the material by water and remain there after the water evaporates, forming permanent discolorations and assisting in the formation of sulphuric and other acids which eat away the surface.

5. In case of fire, the damage by water to the stored contents on floors below where the fire actually occurs, is often greater than that done by the fire itself, which is an important consideration in determining fire insurance risks.

The destructive action of water is apparent at a glance in most building construction exposed to the weather, but, in spite of this, adoption of preventive measures is neglected.

Even when waterproofing is specified, if the necessity to economize in the total cost of the structure arises, the waterproofing or dampproofing is too often the first item to be cut, mainly because its absence is not noticeable until some time after the structure is completed. The work can be done later, when the necessity becomes more apparent, but only at a much greater expense than if done at the time of construction.

The proper time to waterproof, for economy and efficiency, is at the time of construction.

It is universally understood that a roof must be waterproofed, then why not waterproof the faces of a structure exposed to all weathers? High winds, driving a heavy rain, may cause greater temporary water pressure against these surfaces than on the roof. The paint manufacturer's slogan, "Save the surface and you save all" is fully applicable to any construction work exposed to even the smallest quantity of water.

From the foregoing, it is evident that it is not sufficient merely to waterproof that part of a structure subjected to actual heavy water pressure, constant or intermittent, but that it is also vitally necessary to render every part of the structure impermeable to the entrance of even the smallest quantity of water.

The additional cost of waterproofing basements and exteriors, protecting floors from abrasion, dry rot, action of acids, oils and fumes is so small a part of the total cost of any building (1% to 2%) that it is negligible compared with the greater durability, improved appearance and increased satisfaction that results. The amount spent for protection is frequently saved annually in reduced repair bills and lowered depreciation of the structure.

Waterproofing must be done with the proper materials and methods suitable for various conditions, otherwise it is useless. The manufacturers of waterproofing products know best how their products should be used and the purposes and limitations of each, therefore, their specifications should, in all cases, be followed implicitly in every detail.

Meaning of the terms

WATERPROOFING in the fullest meaning of the term is more than the prevention of the entrance of water into or thru the construction. It is also the protection of all the surfaces of a structure against:—

- Penetration of water or dampness
- Wearing away, dusting and disintegration of floors
- Staining and discoloration of surfaces
- Hair cracking, checking and crazing
- Efflorescence
- Opening of expansion joints or joints between two different forms of construction
- Destruction of monolithic bond between old and new work
- Formation and action of rust upon metals
- Action of acids, smoke, alkalies and fumes incidental to manufacturing processes
- Germination of fungi and insects

Waterproofing, in this connection, therefore, resolves itself into 4 phases—

1. Waterproofing, substructural and superstructural, which renders the construction impermeable to water when present in large quantities and under heavy pressure.

2. Dampproofing, substructural and superstructural, which renders the surface of the construction impermeable to water intermittently present in small quantities, not amounting to a head of water pressure.

NOTE:—A head of water pressure means the depth of a volume of water around the outside of a structure, or in the cases of reservoirs, pools and tanks, in the inside, that is held by the walls and floor of that structure. Water seeking to find its own level, endeavors to force itself by capillary attraction thru the pores of the walls and floors of such structures, and will do so provided the depth or dead weight of the water is sufficient to overcome the frictional resistance of the surfaces of the pores. It follows, therefore, that a waterproofing is also naturally and inherently a dampproofing, but a dampproofing is never a waterproofing.

3. Wearproofing of surfaces.

4. Protection of surfaces against acids, alkalies, frost and other destructive agencies.

For waterproofing purposes, building construction of all kinds is divided into three classes:—

a. Construction below grade level, construction either above or below grade level intended to hold water, and roof construction.

This requires either waterproofing to keep out or retain water under constant pressure or dampproofing to prevent penetration of water.

b. Exposed construction above grade level.

This requires dampproofing to prevent saturation with rain or snow water.

c. Floors graded to outlets.

This requires dampproofing to prevent penetration of water into the surface.

In waterproofing reinforced concrete walls and floors that are subjected to a hydrostatic head, it is necessary that the wall or floor be strong enough to resist the water pressure, for the waterproofing itself is not a structural element.

The hydrostatic head to be used in designing tanks, reservoirs and dams is definitely known and must be taken at its full value in accordance with the well known laws of hydrostatic pressure, but the tendency in designing the floors and walls of cellars is to assume a hydrostatic head entirely too large for the existing conditions, with a consequent needless expenditure of money.

Every foundation and basement floor should, if possible, be constructed with a good drainage system to relieve the water pressure to the extent that the hydrostatic head may be computed at about 50% of the maximum. Where the drainage system is liable to become clogged or in cases of actual constant water pressure the maximum pressure must be considered.

Retaining walls for earth pressure are often designed to resist the pressure of a fluid one-half the density of water. This is a safe rule to follow in designing walls for basements located in any but swampy ground. In cases of actual constant water pressure the walls should be designed in layers one foot in height, each calculated to resist the water pressure to which it will be subjected See tables, pages 78, 79.

There are two systems of waterproofing—INTEGRAL and MEMBRANE.

Integral Waterproofing

By the integral method, the mass is rendered impervious to water by incorporation within the mass, of a water repellent that becomes an integral part of the mass. The compressive strength of concrete waterproofed by the integral method increases with age over that of unwaterproofed concrete.

Integral Waterproofing may be accomplished in three ways—

a. By incorporating the waterproofing with the building materials at time of construction. This method is only applicable to new construction into which Portland cement and water enter.

b. By incorporating the waterproofing with Portland cement and sand in the form of a Portland cement plaster coat, monolithically bonded to any kind of masonry construction. This method is applicable either to old or new construction.

c. The third method takes advantage of the fact that finely ground iron on simultaneous contact with air and water rusts very rapidly and in so doing increases in volume fourfold. For this purpose finely ground iron is mixed with water to a thick paste and brushed on the surface, penetrating the pores, and almost immediately rusting. The expansion, consequent from rusting, serves to bond monolithically the ground iron coating to the surface.

The best method of Integral Waterproofing is to add the waterproofing material to the mixture by means of the gauging water. The material therefore, must be of the same specific gravity as water and water soluble or water miscible, so that it is either dissolved or held in suspension, to ensure its equal distribution throughout the mixture.

Integral Waterproofing must be of such a nature that it will be deposited in the pores of the mixture being waterproofed by the evaporation of excess water, forming a permanent water repellant lining.

Integral Waterproofing is applicable to practically all forms of construction, except where there are likely to be vibration strains and stresses, or settlement which will cause the construction to crack.

In these cases the danger of leakage thru such cracks can be obviated by the use of a Membrane Waterproofing in addition to the Integral Waterproofing.

Membrane Waterproofing

Means applying to the surface of any kind of construction, a covering composed of alternate layers of felt, or fabric, bound together with a plastic material that is waterproof. This forms what may be called a waterproof envelope covering the parts of the construction exposed to water.

Membrane Waterproofing is applicable to either old or new construction.

The best form of Membrane Waterproofing for any kind of construction is the application of layers of bitumen (asphalt) saturated felt, or in cases of heavy construction or severe vibration strains and stresses, of bitumen saturated fabric, tightly covering the surface and coated on top with hot bitumen.

The real waterproofing is the bitumen in the felt or fabric and the bitumen used when the plies are laid and coated. The strands of the felt or fabric impart tensile strength to the whole coating in the same manner that expanded metal or reinforcing bars do to concrete.

The tensile strength and elasticity of membrane waterproofing,—which means its ability to bridge without cracking, any cracks or breaks that occur in the construction to which it is applied—are governed by the strength and elasticity of the felt or fabric. Therefore, the greater the tensile strength and elasticity of the felt or fabric in conjunction with the ductility and melting point of the bitumen the greater the waterproofing strength.

Bitumen is better and longer lived than coal tar products because it is uneffected by comparatively high or low temperature changes, (governed by its own melting point, which is always higher than that of coal tar products) by acids or chemicals, is absolutely water insoluble and immiscible, and, unlike coal tar has no water content. Asphalt (bitumen) Membrane Waterproofing is the oldest and best method of actually waterproofing against any head of water pressure. It is applicable to practically all conditions because bitumen is immune from anything except heat and oils. A Membrane Waterproofing also is elastic and will withstand strains and stresses that cause concrete or masonry to crack. Membrane Waterproofing however, is expensive, because

1. It does not bond monolithically, to any surface and therefore requires sufficient additional backing up of masonry or concrete to keep it in place against even very slight dampness or head of water pressure.
2. Fully as much of the success of Membrane Waterproofing depends upon the care and skill of the men placing it, as upon the materials themselves.
3. The Membrane waterproofing requires protection from damage.
4. If a leak should develop the Membrane waterproofing is concealed behind or below the backing up concrete or masonry, entailing much hard cutting to locate and repair the leak.

For these reasons the Integral Method of Waterproofing is cheaper and more applicable than Membrane in all cases, except where the work in which it is used may crack either from settlement or vibration, or in cases where the water in contact with the integrally waterproofed work may contain acids and chemicals that will destroy the cement.

Another objection to Membrane Waterproofing alone is that it affords no protection against water penetrating through—and its consequent destructive action upon—that part of the structure carrying the Membrane Waterproofing that is in actual contact or saturated with water.

Dampproofing

Dampproofing consists of a water repellant coating that will penetrate into and fill the pores of any surface. It is applicable to new construction below grade level and to both old and new construction above grade level.

Dampproofing must always be applied to the surface exposed to water, never on the opposite surface.

The object of waterproofing or dampproofing is to prevent the entrance of water into the surface or through the mass. If dampproofing is applied to the surface opposite that at which the water enters, the water, penetrating through the mass, will force the coating out of the pores of the inner surface. When applied to the exposed surface the presence of water merely tends to hold the dampproof coating tightly in the pores of the surface.

A dampproof coating can be applied effectively to the inner faces of brick and tile walls above grade that will afterwards receive a lime or gypsum plaster finish. In this case the plaster finish will back up the dampproof coating sufficiently to keep it in place against the pressure of water that may soak through from the outside.

The best dampproofings are those applied by means of a brush or spray in the form of a paint or wash, black, transparent or colored. In all cases it is essential that the dampproofing penetrates into the pores of the surface, is sufficiently elastic to conform to expansion and contraction of the surface, is water repellant and insoluble and is unaffected by acids or alkalies that may come in contact with it, (either in the water in contact with it or in the surfaces to which it is applied).

Smoke and Acid-Proofing Cement, Brick, Plaster, Wood or Metal Surfaces

The complicated industrial processes of the present day almost without exception employ at one stage or another, the use of one or more acids or other chemical agents in the manufacture of their finished product. Some of these chemicals are used merely as agents to produce certain desired results, others are liberated in the form of fumes or gases, while still others enter into or become the finished products.

All these acids and chemical agents, either in solution or in the form of smoke, gas, or fumes have a more or less disintegrating effect on the materials which enter into the construction of their containers or the factory buildings in which they are used. The destructive tendencies of many of these acids and chemicals are often materially increased by contact with water, moisture or steam.

Conditions of this kind necessitate the application of some form of protective coating to masonry, concrete, wood or steel entering into the construction of either the buildings or of the tanks, containers or vats used for the preparation or storage of the products.

Such a coating must be of a strongly adhesive nature to enable it to stick to the surface to which it is applied; must dry into a firm, hard coating and yet remain sufficiently elastic to take up any expansion or contraction of the surface without cracking and must remain plastic under varying degrees of temperature. In other words, it must combine with and become an integral part of the surface it is designed to protect. Above all, it must contain only such elements that will remain neutral and unaffected by the chemicals, in either their pure or diluted form, with which it will be brought in contact. In addition it must exert no harmful effect upon the surface to which it is applied.

Acids may be roughly divided into two classes—organic and inorganic, and the chemical reactions of the various acids comprising these two classes with the different elements entering into the composition of the wide range of materials used in construction work, are so numerous and varied that the problem of designing one single coating to fulfill all the necessary conditions is a complicated if not impossible one.

Elements uneffected by certain other elements under one set of conditions may become unfavorably effected by these elements under different conditions. Materials that will resist organic acids are usually impotent against the action of stronger inorganic or mineral acids.

The one liquid coating that is least affected by inorganic or mineral acids, which are the most destructive in their action upon the greater number of materials entering into building construction, is pure refined bitumen. Yet this material is almost entirely ineffective against oils, which are its natural solvents.

A refined bitumen coating is most effective when used in its natural state. To be applied it must be melted and brushed on hot. It is fairly effective when manufactured into a paint and brushed on cold but the addition of the volatile vehicle nesessary to keep it in paint form, decreases the body of the film that subsequently remains on the surface, thereby proportionately diminishing the quantity of the protective element interposed between the acid and the surface to be protected. The main objection to its use in most cases is the black appearance it gives to the finished surface, but the few coloring pigments that are not destroyed by the bitumen itself, and can therefore be used to color it, are very susceptible to the action of chemicals and would detract from the resistive powers of the bitumen coating.

A coating to resist the action of organic acids and very dilute solutions of certain of the inorganic mineral acids can be produced from combinations of elements other than those contained in bitumen, with the result that such coatings are practically colorless and do not materially change the finished appearance of the surface to which they are applied.

The only practical coating to counteract the action of oils upon certain materials entering into building construction is one composed almost entirely of metallic elements. Oil enters into the composition of nearly all coatings designed for the before mentioned purposes and it will, when in contact with such coatings, soften them by combining with the oils they contain thereby detracting from their immunity.

The problem therefore resolves itself into the necessity for the use of what may be called four classes of coatings to be used for the protection of the finished surfaces of the materials entering into building construction used for industrial and manufacturing purposes, storage of natural products, storage of manufactured products, hospitals, laboratories, dairies.

These classes may be grouped as protective coatings against the action of—

Organic acids and fumes,

Very dilute inorganic or mineral acids and fumes,

Inorganic and mineral acids and fumes,

Oils.

Waterproofing Theory and Practice

TO REALIZE the important part that water content plays in the formation of concrete, cement work and also in the porosity or water permeability of the finished work, it is necessary to consider the action that takes place when water is mixed with cement.

As soon as water comes in contact with a grain of cement it softens the surface by penetration and combines with it to form a colloid, the action commencing on the outside and gradually working in towards the center of the grain of cement.

The lime of the cement combines with the water and colloid, forming lime crystals.

The formation of colloid and crystals in the colloid, continues as long as water is able to work its way towards the center of the grain of cement.

The entire grain of cement, however, is never entirely turned into colloid and crystals; there always remains a small core of untouched cement in the center of the grain.

This is due to the fact that the colloid surrounding the core is greater in volume than the previous size of the grain, because it contains the water that has gone into the formation of the colloid and the crystals, and as the water penetrates it continues forming more and more colloid and crystals until the increased volume of the grain prevents the further penetration of water towards the center.

The strength of all concrete and cement work is governed by the proper formation of the greatest possible quantity of colloid and the number and interlacing of the lime crystals contained in the colloid with each other and with the colloid and crystals of adjacent grains of cement. Therefore, each grain of cement and its colloid and crystals should be in contact and interlacing with the colloid and crystals of all adjacent grains of cement.

When sand is added, these cement cores which are surrounded by colloid and crystals, coat the grains of sand holding them together thus forming mortar. When stone or other aggregate is added, the pieces are coated and held together by the mortar, forming concrete.

If exactly the quantity of water could be used that would all be absorbed by the cement in forming colloid and crystals, the result would be a waterproof mass. This is practically impossible, for in making concrete more water must be used to obtain a mix that will be easily workable and capable of proper handling and placing than is required for the formation of colloid and crystals, this surplus water is called "excess water." Concrete and cement work kept wet for a long period of time develop more colloid and crystals, and consequently, greater strength, than that from which the water is allowed to evaporate and the work left dry.

After the water has penetrated into the grain of cement as far as the development of colloid and crystals will allow, the excess water evaporates from the surface of the work, leaving pores or voids in the mass that were previously occupied by the excess water. Where a molecule of water has passed out another molecule of water may enter, and owing to capillary attraction may be drawn through all the pores of the entire mass from which the excess water evaporated.

Concrete and cement work may be made practically water-tight under laboratory conditions, supervision and care, without the addition of any waterproofing medium, on the theory that although the pores through which the excess water has evaporated can afterward admit water, yet, owing to the tendency of the colloid of the cement to swell on contact with water, such swelling closes the pores before the water can penetrate very deeply into the mass.

It is, however, practically impossible to duplicate laboratory conditions in the field, which is the main reason why field tests cannot measure up to laboratory tests in results. It is therefore necessary to adopt some method of preventing the later entrance of water into the pores through which the excess water evaporated.

An inert filler of greater fineness than cement will not do this effectively, for two reasons—

First: Such a filler has a tendency to become segregated, forming patches in the mass that would contain no cement, thereby making the mass easily water permeable and decreasing the homogeneity and strength of the mass.

Second: Such a filler cannot be absorbed by the cement or the colloid, and it would therefore, displace an equal volume of cement, detracting that much from the strength of the mass. If of greater fineness than cement then the presence of filler between the grains of cement would prevent the junction of the colloid and crystals of adjacent grains, thereby greatly weakening the strength of the mass.

A filler, like hydrated lime or diatomaceous earth, is effective as a *dampproofing*, against capillary attraction unaccompanied by hydrostatic pressure, because it acts as a lubricant for the mixture enabling all the particles contained in the mix to pack closer together, thereby creating a denser mass. Both, however, are soluble in water and, under pressure will leach out, leaving the work porous.

The report of tests by Professor Duff Abrams of the Lewis Institute, Chicago, Illinois, published in Materials Research Laboratory Bulletin No. 8 shows that the addition of *any* dry admixture to cement will reduce the compressive strength of the resultant work

GUIDE

by about the same percentage the admixture bears to the cement.

The only effective way absolutely to waterproof concrete or cement work is by the use of a compound that will combine chemically with the colloid of the cement at time of formation, producing a water repellant lining for the pores by being deposited therein as the excess water evaporates.

To accomplish this result the waterproofing in the mass must be either a water repellant or become so by chemical change when in contact with the colloid of the cement.

A waterproofing of this nature can be in the form of, either:—

1. A powder to be uniformly mixed with the dry cement and afterwards picked up by the water and distributed equally throughout the mass to combine with the colloid and, becoming heavier than water, be precipitated in the pores containing the excess water.

2. A paste of the same specific gravity as, and either soluble or miscible in water, so that it is carried by the water equally throughout the mass, and, then, on contact with the colloid it will act in the same manner as a powder waterproofing described above.

In all concrete and cement work water is an important factor, especially in integrally waterproofed work, and for the reasons already explained, plays an important part in the ultimate strength and degree of permeability of the mass.

If too little water is used there will not be enough for the proper development of colloid and crystals although this is only likely to occur in cement work made under compression.

If only just enough water is used for this proper development of colloid and crystals then the mass will be too stiff and unworkable.

If a great excess of water is used the finer flour of the cement will be washed out of the mixture onto the surface of the mass, forming laitance or efflorescence. This will occur before the formation of colloid and crystals thereby robbing the mass of the strength that would have been developed by the formation of colloid and crystals by that quantity of cement. This is the main cause of lack of strength and great porosity of concrete and cement work.

The quantity of water required merely for hydrating cement, that is combining with it to form all the colloid and crystals possible without any excess, is not definitely known and varies somewhat with different brands of Portland Cement, but it is usually considered that the maximum is about 20% of the weight of the cement.

A bag of cement usually weighs 94 lbs. so this gives about 2¼ gallons of water that will be absorbed by the cement in the proper formation of colloid and crystals.

As pointed out by Professor Duff Abrams in the Lewis Institute Materials Research Laboratory pamphlet "Design of Concrete Mixtures" every pint of excess water is equivalent, in the resultant strength of the work, to taking 2 lbs. of cement out of the mixture.

For cement work, except that made under compression, 2¼ gallons of water per bag of cement produces too dry a mixture to be easily worked and placed. A perfectly workable mix is obtained by using 3 gallons of water per bag of cement.

Concrete requires about twice as much water per bag of cement because the mortar has to be plastic or sloppy enough to coat each piece of stone. It therefore, requires about 6 gallons of water per bag of cement to produce a workable mix, although from 4½ to 5 gallons would be more than enough for the formation of colloid and crystals.

The porosity of concrete and cement work is governed absolutely by the size, not the number of pores through which the excess water evaporates. Roughly speaking, it will require 260 pipes (or holes or pores) $\frac{1}{16}''$ in diameter to permit the passage of a volume of water equal to that passing through one pipe (hole or pore) 1″ in diameter. This would seem to indicate that a mass containing a great number of small pores would not be so easily water permeable as a mass containing a few larger pores, provided the total diameter of the small pores did not equal the diameter of the large pores, but there is a law of hydrostatics called "positive capillarity" which demonstrates that water will be drawn to a greater height through a small pipe or pore than through a large one.

This is caused by what may be called the "climbing power" of the molecules of water in contact with the surfaces of the pores (or pipes) due to the minute depressions on the surface into which the molecules enter and draw other molecules up with them.

This will continue until the weight of the molecules sustained in the pore is sufficient to overcome the hold of the molecules to the irregularities of the surface and to each other which marks the limit of positive capillarity.

In the diameter of a large pore there is a greater volume or weight of molecules of water to be sustained than in the diameter of a smaller pore, so positive capillarity ceases sooner in a large pore than in a small one.

In cement work the quantity of water to be used is determined by the mixture itself. If there is a great excess of water the mixture will be too soft and sloppy, and if too little water is used the mixture will be too dry to be economically and effectively placed.

A large percentage of the concrete throughout the country is made with a great excess of water, except where the cement water ratio theory is understood and used. In fact many contractors do not know how much water they use per cubic yard of concrete or bag of cement. Generally the quantity of water runs from 40 to 70 gallons per cubic yard of concrete.

The following table shows the effects of using an excess of water, upon the ultimate porosity of the mass.

110 gals. of water per cubic yard of concrete will produce 40% more voids

70 gals. of water per cubic yard of concrete will produce 20% more voids

50 gals. of water per cubic yard of concrete will produce 10% more voids

40 gals. of water per cubic yard of concrete will produce 5% more voids

35 gals. of water per cubic yard of concrete will produce 3% more voids

Each 5 gallons of water in excess of 30 gallons per cubic yard of concrete, will produce approximately 2½% more voids in the mass, due to the evaporation of the excess water.

If only 30 gallons of water are used per cubic yard of concrete the mixture will be too dry to be easily worked or placed. Actual experience proves that 35 gallons per cubic yard will produce a workable concrete that can be properly placed and this will only give an excess of 3% of voids due to the evaporation of the excess 5 gallons of water.

GF Waterproofing and Preservative Products

GF Waterproofing and Preservative Products are all specially designed for their respective purposes. Each is intended to protect some certain part or form of building construction, old or new, against various kinds of destructive influences, inherent or otherwise, that may be encountered.

GF Waterproofing and Preservative Products have been used for many years in every part of the civilized world, under many varying and extreme conditions. They are guaranteed to fulfill their various functions when used for the purposes for which they are designed and recommended, in the manner, and under the conditions specified for each.

GF Waterproofing and Preservative Products are the cheapest obtainable in the sense that, where durability and efficiency are concerned, the best is the cheapest.

The complete line of GF Waterproofing and Preservative Products consists of 32 products, each designed and intended for some special function in the preservation of all kinds of building construction.

GF 10 Waterproofing Paste
GF 11 Waterproofing Powder
GF 12 Cement Accelerator and Frost Preventive
GF 12 Colored
GF 12 Colored Wax
GF 13 Lime Mortar Accelerator
GF 14 Ironcote Waterproofing
GF 16 Foundation Coating
GF 17 Bitumen
GF 18 Felt
GF 21 Fabric
GF 99 Acidproofing
GF 100 Transparent Waterproofing
GF 101 Brick and Cement Coating
GF 102 Cement Paint
GF 140 Metallic Hardener
GF 141 Metallic Oilproofing
GF 145 Crystalrox
GF 155 Cement Floor Enamel
GF 156 Floor Lacquer
GF 160 Wood Preservative
GF 200 Dampproof Coating
GF 220 Stainproof Stone Backing
GF 250 Mastic Cement
GF 251 Window Caulking Compound
GF 252 Rubber Caulking Compound
GF 253 Brush Coating
GF 300 Steel Coating
GF 325 Protective Coating for Steel
GF 350 Galvanized Iron Coating
GF 400 Bonding Compound
GF 550 Timber Preservative

GF Waterproofing and Preservative Products, their purposes and methods of use, are fully described in other sections of this book.

HOW TO USE THE WATERPROOFING HANDBOOK

1. First of all, if you are not already familiar with the theory and practice of waterproofing, read pages 5 to 11 inclusive. Necessarily brief, these pages contain valuable information for the man using waterproofing of any kind.

2. Make use of the index on page 4.

3. Use the Specification Guide on pages 13, 14, 15, 16 and 17. A thumb tab is provided for ready reference.

The Specification Guide is divided into five sections:

1. Sub-Structural Waterproofing.
2. Super-Structural Waterproofing.
3. Cement and Wood Floor Preservation.
4. Technical Paints and Coatings.
5. Acidproof Coatings.

Under these sections are listed the various conditions found in the particular class of work. First, determine under which classification the particular job may come. For example, we have a basement subjected to water pressure from the outside. Basements being part of the sub-structural work, we turn to "Sub-Structural Waterproofing," look under "condition" and find that there are two methods of waterproofing basements, and that seven GF products may be used. If the basement is already built, it is obvious that the integral method is eliminated, so refer to the other pages indicated, where complete description and specifications may be found.

Take another example. It is desired to repair a cement floor which has cracked in several places. Section III "Cement and Wood Floor Preservation" would be the proper heading. About half way down is the subhead "Filling Cracks in Floors," and three methods are listed. Read the description under the different products, determine which method is applicable and follow directions.

4. Following the Specification Guide are the various GF products, arranged according to their numerical titles. Immediately below the name is a list of the purposes for which it may be used, and following this is a description of the GF products. General data, such as colors, weights, etc., precede the specifications. Where the GF product is used for several different purposes, the specifications are grouped under their specific heads.

5. At the back of the book are three pages of handy data.

Summarizing:

> If you have a specific condition and want the remedy—consult the Specification Guide.
>
> If you know the product's name but want to know its uses, refer to the index, or thumb through the pages until you find it. Products are listed numerically.

Should you desire information not contained in the handbook, feel free to consult our Waterproofing Engineering Department.

SPECIFICATION GUIDE

Section I—Sub-Structural Waterproofing

Methods and Materials for the Waterproofing of Foundations, Basements, Pits, Tanks, Pools, Containers and other Structures subjected to Hydrostatic Pressure or Dampness.

Condition	Method	Product	Described On Page
Waterproofing Against Pressure From Outside or Inside, Basements, Pits, Pools, Tanks, Reservoirs and Boiler Rooms	(a) Integrally	GF 10 GF 11	19 32
	(b) Plaster Coat	GF 10 GF 14	21 41
	(c) Felt Membrane	GF 17 & 18	44 & 46
	Fabric Membrane	GF 17 & 21	44 & 49
Waterproofing Against Pressure From Inside only, Pools, Tanks and Reservoirs	(a) Integrally	GF 10 GF 11	19 32
	(b) Plaster Coat	GF 10 GF 14	22 41
	(c) Felt Membrane	GF 17 & 18	44 & 46
	Fabric Membrane	GF 17 & 21	44 & 49
	(d) Brush Coating	GF 16	43
	(e) Transparent Coating	GF 100	52
	(f) Trowel Coating	GF 250	69
Waterproofing Bridges	(a) Felt Membrane	GF 16, 17 & 18	44 & 46
	Fabric Membrane	GF 16, 17 & 21	44 & 49
Waterproofing Wood Floors	(a) Felt Membrane	GF 17 & 18	44 & 46
	Fabric Membrane	GF 17 & 21	44 & 49
Waterproofing Mortar Joints	(a) Integrally	GF 10 GF 11	26 32
	(b) Integrally	GF 12 GF 13	33 40
Dampproofing Against Seepage Below Grade	(a) Brush Coating	GF 16 & 17	43 & 44
	(b) Trowel Coating	GF 250	69
Dampproofing Floors Below Grade	(a) Brush Coating	GF 16 & 17	43 & 44
	(b) Trowel Coating	GF 250	69
Dampproofing, Frostproofing, Accelerating and Hardening Cement	(a) Integrally	GF 12	33
Dampproofing, Frostproofing, Accelerating and Hardening Lime & Gypsum	(a) Integrally	GF 13	40
Repairing Leaks and Damage to Waterproofing	(a) Patching	GF 10 & 11 GF 14	25 25 & 41

SPECIFICATION GUIDE

Section II—Super-Structural Waterproofing

Methods and Materials for Rendering Walls and Roofs proof against Weathering and Dampness; for the Stainproofing of Cut Stone; for the Preservation and Beautifying of Stucco, Brick and Concrete Walls and for Filling Expansion Joints.

Condition	Method	Product	Described On Page
Waterproofing Brick, Stone, Stucco and Concrete Walls	(a) Transparent Coating (b) Colored Coating (c) Cement Paint (d) Elastic Coating	GF 100 GF 101 GF 102 GF 250	52 55 57 68
Waterproofing Sand Lime Brick	(a) Transparent Coating (b) Colored Coating (c) Cement Paint	GF 100 GF 101 GF 102	53 55 57
Waterproofing Cement Stucco	(a) Integrally (b) Transparent Coating (c) Colored Coating (d) Cement Paint	GF 10 GF 11 GF 100 GF 101 GF 102	27 32 53 55 57
Waterproofing Magnesite Stucco	(a) Integrally (b) Transparent Coating (c) Colored Coating (d) Cement Paint	GF 10 GF 11 GF 100 GF 160 GF 101 GF 102	29 32 53 64 55 57
Waterproofing Interiors or Exteriors of Concrete and Brick Containers	(a) Transparent Coating (b) Colored Coating (c) Cement Paint (d) Brush Coating	GF 100 GF 101 GF 102 GF 16	53 55 57 43
Dampproofing and Insulating Interior Brick and Tile Walls Above Grade	(a) Brush Coating (b) Trowel Coating	GF 200 GF 250	65 69
Waterproofing Cement Mortar	(a) Integrally	GF 10 & 11	32
Dampproofing Accelerating and Hardening Cement Mortar	(a) Integrally	GF 12	33
Dampproofing and Coloring Cement Mortar	(a) Integrally	GF 12 Colored	37
Dampproofing Accelerating Set and Hardening Lime Mortar	(a) Integrally	GF 13	40
Dampproofing and Coloring Lime Mortar	(a) Integrally	GF 12 Colored	37
Waterproofing Cement Floors	(a) Integrally	GF 10 GF 11 GF 140	29 32 58
Dampproofing Cement Floors	(a) Integrally (b) Transparent Coating (c) Colored Coating	GF 12 GF 100 GF 145 GF 155 or GF 156 GF 12 Colored	33 53 60 62 37
Protecting Wood Trim	(a) Brush Coating	GF 200	65
Stainproofing Stone	(a) Brush Coating	GF 145 GF 220	61 67
Preventing Efflorescence	(a) Transparent Coating (b) Colored Coating (c) Cement Paint	GF 100 GF 101 GF 102	53 55 57
Caulking Windows	(a) Elastic Fill	GF 251 GF 252	70 71
Expansion Joints	(a) Elastic Fill (b) Hot Fill	GF 250 GF 17	69 44
Filling Cracks and Tuck Pointing	(a) Elastic Fill (b) Elastic Fill (c) Hard Fill	GF 250 GF 251 GF 252 GF 14	69 70 71 42
Cement Wash	(a) Integrally (b) Coating	GF 12 GF 102	33 57
Roofing and Repairing Leaky Roofs	(a) Brush Coating (b) Trowel Coating (c) Transparent Coating (d) Colored Coating (e) Felt Membrane (f) Fabric Membrane (g) Integrally	GF 253 GF 250 GF 100 GF 101 GF 16, 17 & 18 GF 16, 17 & 21 GF 10 GF 11	71 70 53 56 44 & 46 44 & 49 21 32
Decorating and Protecting Walls and Ceilings	(a) Colored Coating (b) Cement Paint	GF 101 GF 102	56 57
Boiler Insulation	(a) Trowel Coating	GF 250	70
Preserving Painted Signs	(a) Transparent Coating	GF 145	60
Preparing Newly Plastered Walls	(a) Transparent Coating	GF 145	60

SPECIFICATION GUIDE

Section III—Cement and Wood Floor Preservation

Methods and Materials for Hardening, Dustproofing, Decorating and Waterproofing Cement and Wood Floors; for Accelerating the Setting and Preventing the Freezing of Newly Laid Cement Floors.

Condition	Method	Product	Described On Page
Hardening and Oilproofing Cement Floors	(a) Integrally	GF 140 GF 12	58 33
	(b) Transparent Coating	GF 145	60
Painting Interior Cement and Composition Floors	(a) Transparent Coating	GF 155 Trans	62
	(b) Colored Coating	GF 155 or GF 156	62
Painting Exterior Cement and Composition Floors	(a) Transparent Coating	GF 155 Trans	62
	(b) Colored Coating	GF 101	55
Dampproofing, Hardening, Accelerating Set and Frostproofing and Coloring Cement Floors	(a) Integrally	GF 12	33
	(b) Integrally	GF 12 Colored	37
Revivifying Old Cement Floors	(a) Transparent Coating	GF 145	60
	(b) Gloss Coating	GF 155 Trans	62
	(c) Colored Coating	GF 155 or GF 156	62
	(d) Wax Coating	GF 12 Wax	39
Patching Cement Floors		GF 12	37
		GF 14	42
		GF 400	75
Filling Cracks in Floors	(a) Cold Elastic Fill	GF 250	69
	(b) Hot Elastic Fill	GF 17	44
	(c) Hard Fill	GF 14	42
Undercoat for Cork or Linoleum	(a) Transparent Coating	GF 145	60
	(b) " "	GF 100	29
Preserving Cork, Magnesite, Linoleum and Composition Floors	(a) Transparent Coating	GF 160	63
Hardening Mosaic and Terrazzo Floors	(a) Transparent Coating	GF 145	60
Preserving Mosaic and Terrazzo Floors	(a) Transparent Coating	GF 155 Trans	62
Preserving Wood Floors	(a) Transparent Coating	GF 160	63
Waterproofing Wood Floors	(a) Felt Membrane	GF 17 & 18	44 & 46
	(b) Fabric Membrane	GF 17 & 21	44 & 49
	(c) Trowel Coating	GF 250	69

SPECIFICATION GUIDE

Section IV—Technical Paints and Coatings

Methods and Materials for Rendering Walls, Floors and Containers Proof against Acids and Oils; for Protecting Structural Steel and Galvanized Surfaces from Rust, and Timbers from Dry Rot and Decay; for Bonding New Concrete to Old; for Waterproofing and Hardening Cast Stone and Cement Blocks and Stainproofing Limestone.

Condition	Method	Product	Described On Page
Protecting Brick, Cement, Tile, Plaster, Wood or Metal Surfaces from Acids, Smoke or Fumes	(a) Transparent Coating (b) Hot Coating (c) Brush Coating	GF 99 GF 17 GF 325	51 45 73
Protecting Masonry and Cement Surfaces from Weak Acids and Fumes	(a) Transparent Coating	GF 145	60
Stainproofing Stone and Marble	(a) Transparent Coating	GF 145	60
Protecting Structural Steel from Acids, Alkalies, Rust and Electrolysis	(a) Black Coating (b) Colored Coating	GF 325 GF 300	73 72
Protecting Galvanized Iron, Tin and Zinc	(a) Transparent Coating	GF 350	74
Oilproofing Concrete Tanks	(a) Plaster Coat	GF 141	59
Painting newly Plastered Walls	(a) Transparent Coating	GF 145	60
Protecting Posts, Trusses and Trim	(a) Transparent Coating	GF 160	64
Protecting Exposed and Embedded Timber	(a) Brush or Spray Coat	GF 550	76
Road Repairs	(a) Integrally	GF 12	37
Waterproofing, Hardening, Accelerating Set, Frostproofing and Coloring Cast Stone and Cement Products	(a) Integrally	GF 10 GF 11	31 32
	(b) Integrally	GF 12	37
	(c) Integrally	GF 12 Colored	31 & 37
	(d) Transparent Coating	GF 100	53
	(e) Transparent Coating	GF 145	31 & 60
	(f) Colored Coating	GF 101	56
	(g) Colored Coating	GF 102	57
Frostproofing, Accelerating Set, Dampproofing and Hardening Cement	(a) Integrally	GF 12	35
Frostproofing, Accelerating Set, Dampproofing Lime and Gypsum	(a) Integrally	GF 13	40
Coloring Cement Lime and Gypsum	(a) Integrally	GF 12 Colored	37
Accelerating, Dampproofing Oil Well Linings	(a) Integrally	GF 12	37
List of Acidproofings	GF 17, 99, 141, 145, 220, 325		Sec. V

SPECIFICATION GUIDE

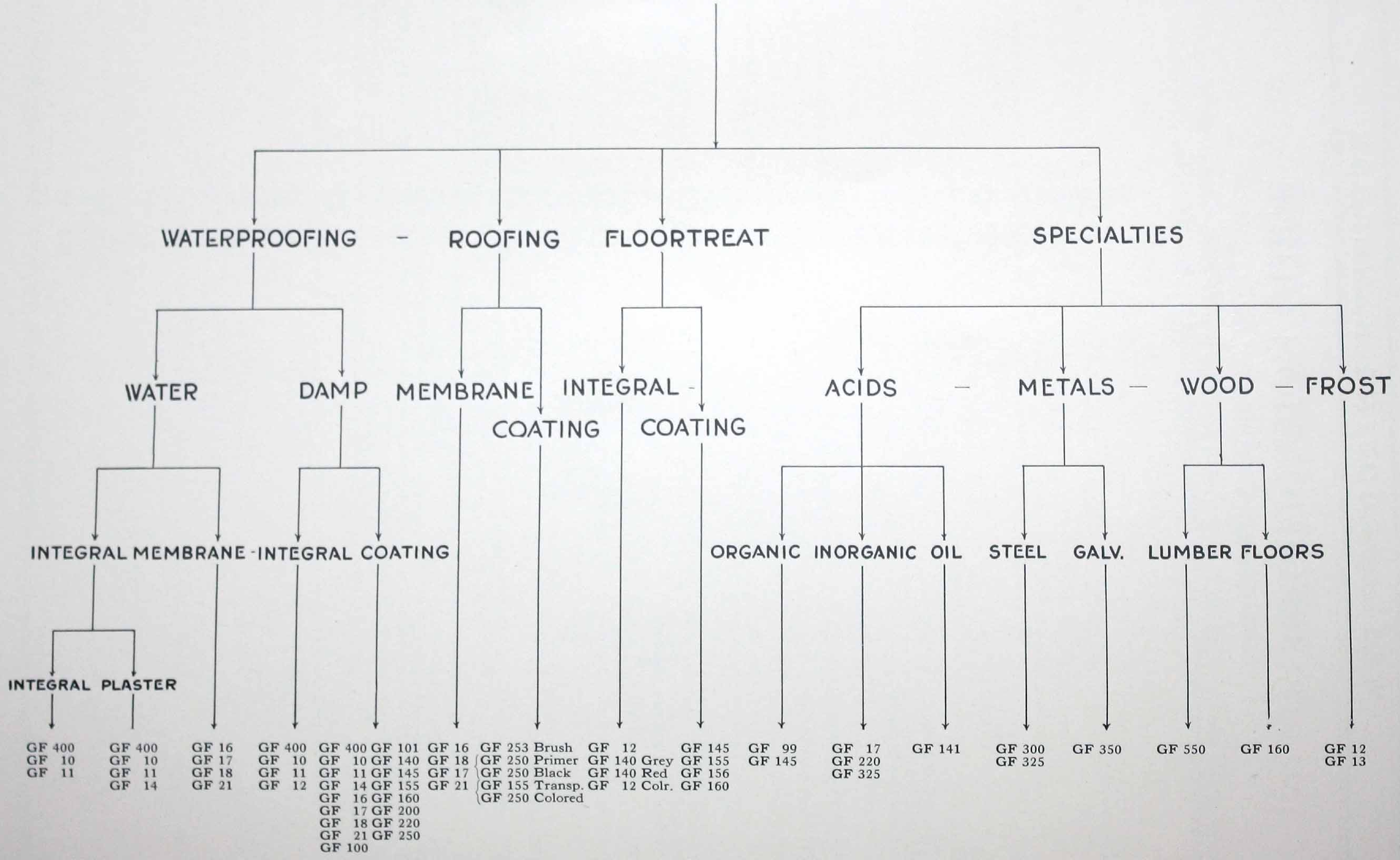
Section V—Acidproof Coatings

The following table shows the acids and chemicals in most general use in manufacturing processes and the various GF Acidproof coatings that are best applicable to counteract their destructive influences upon building material.

Condition	Product	Decribed On Page
Acetic Acid	GF 99	51
	GF 220	67
	GF 325	73
	GF 145	60
Albumen	GF 99	51
Alcohol	GF 99	51
Alkalies	GF 99	51
Alum	GF 17	44
Ammonia	GF 17	44
	GF 99	51
Blood	GF 99	51
Cabbage	GF 17	44
Caustic Potash 50% Solution	GF 99	51
Caustic Soda 50% Solution	GF 99	51
Causticity of Plastered Surfaces	GF 145	60
Creosote	GF 145	60
Chlorides	GF 17	44
Cyanides	GF 220	67
	GF 325	73
Disinfectants	GF 99	51
Ensilage	GF 99	51
Fruit Acids	GF 145	60
Garbage	GF 99	51
	GF 220	67
	GF 325	73
Hot Grease	GF 141	59
Hydrofluoric Acid	GF 17	44
Hydrochloric Acid	GF 17	44
Hydrochloric Acid 25% Solution (Muriatic)	GF 99	51
Lactic Acid	GF 99	51
	GF 145	60
Live Steam	GF 99	51
Malic Acid	GF 99	51
	GF 145	60
Malt	GF 17	44
Mineral Acids and Dilutes	GF 17	44
	GF 220	67
Molasses	GF 99	51
	GF 145	60
Nitric Acid	GF 17	44
Oils	GF 141	59
Olive Oil	GF 99	60
Oxalic Acid	GF 145	51
Picric Acid	GF 17	44
Picric Acid 10% Solution	GF 99	51
Sauer Kraut	GF 17	44
Septic Fluids	GF 99	51
Sewage	GF 99	51
	GF 220	67
	GF 325	73
Silage	GF 99	51
Smoke	GF 99	51
Sodium Chloride	GF 99	51
Stainproofing Stone	GF 145	60
Sugar	GF 99	51
	GF 145	60
Sulphuric Acid	GF 17	44
	GF 220	67
	GF 325	73
Tannic Acid	GF 99	51
Vinegar	GF 99	51
	GF 220	67
	GF 325	73
	GF 145	60
Wine	GF 99	51

The proper protective coating for any acid not mentioned above will be the same as that shown for other acids of that class.

GF WATERPROOFING & PRESERVATIVE PRODUCTS



Divisional Chart of GF Waterproofings and Preservative Products showing their various purposes.

GF INTEGRAL WATERPROOFING PASTE (GF 10)

- I *Waterproofing Against Water pressure from Outside*
  Waterproofing Against Water pressure from Inside
    1. *Integrally*
    2. *Plaster Coat Outside or Inside*
- II *Waterproofing Leaky Pits, Basements, Pools, Tanks, Reservoirs and Cement Floors*
    1. *Integrally*
    2. *Plaster Coat Inside*
- III *Repairing Damage to Waterproofing*
    1. *Integrally*
- IV *Waterproofing Cement Mortar Joints*
    1. *Integrally*
- V *Waterproofing Cement Stucco*
    1. *Integrally*
- VI *Waterproofing Cement Blocks, Bricks, Vaults and Artificial Stone*
    1. *Integrally*

DESCRIPTION

GF Integral Waterproofing Paste (GF 10) is a compound which is readily soluble in water. When this solution is added to the concrete it enters into chemical combination with the lime of the cement forming, as the concrete sets, a highly water repellent compound, thoroughly distributed throughout the mass, which effectively seals the pores against the penetration of moisture.

By the use of GF 10 paste perfect distribution of a water repellent throughout the concrete is secured.

GF 10 acts in two ways: First, it imparts to the gauging water a high lubrication value, thereby reducing the amount of water necessary and producing a denser concrete with minimum voids. Second, it forms a permanently insoluble film over the surfaces of these voids, making them water repellent.

To understand the action of GF 10 in concrete and cement work, it is necessary to realize thoroughly just what the function of water is in the formation of concrete.

Recent studies of concrete by Professor Duff Abrams of the Lewis Institute, Chicago, indicate that the gauging water used in mixing concrete has two functions: First, to flush into place all the particles of sand, rock and cement used in mixing the concrete, and, second, to combine with Portland cement in the setting process.

The first function, the flushing of materials into place, requires a somewhat greater amount of water than does the second. As a result, after the concrete has set, there is left in the pores of the concrete a residue of water which was necessary for the flushing process, but which has not been absorbed by the cement. As this excess water evaporates, voids remain which leave the concrete porous and water-thirsty.

It is the nature of GF 10 to act as a lubricant when mixed with the gauging water. For this reason the flushing process is greatly facilitated with a smaller quantity of water and there is a smaller excess left to evaporate after the setting process is complete.

Tests made by the Pittsburgh Testing Laboratory on the flowability of concrete made with untreated water and with water treated with GF 10 in the proper proportions, show that a decrease of 6% of the total water needed can be secured by the addition of the waterproofing paste with no decrease in flowability.

Thus, by the use of GF 10, less gauging water is necessary, a denser and stronger concrete is obtained, and the capillary tubes of the concrete, which cannot be eliminated, are effectively coated with a water repellent material.

The specific gravity of GF 10 is the same as that of water so that once mixed an equal distribution of waterproofing throughout the concrete is assured.

A cubic foot of concrete waterproofed with GF 10 weighs 151½ lbs., an increase in weight, or density, of about 5% over unwaterproofed concrete.

Test of Concrete Waterproofed With GF 10

The following letter gives the results of a test performed by Robert W. Hunt & Company, Testing Engineers, on a concrete cube waterproofed with GF 10

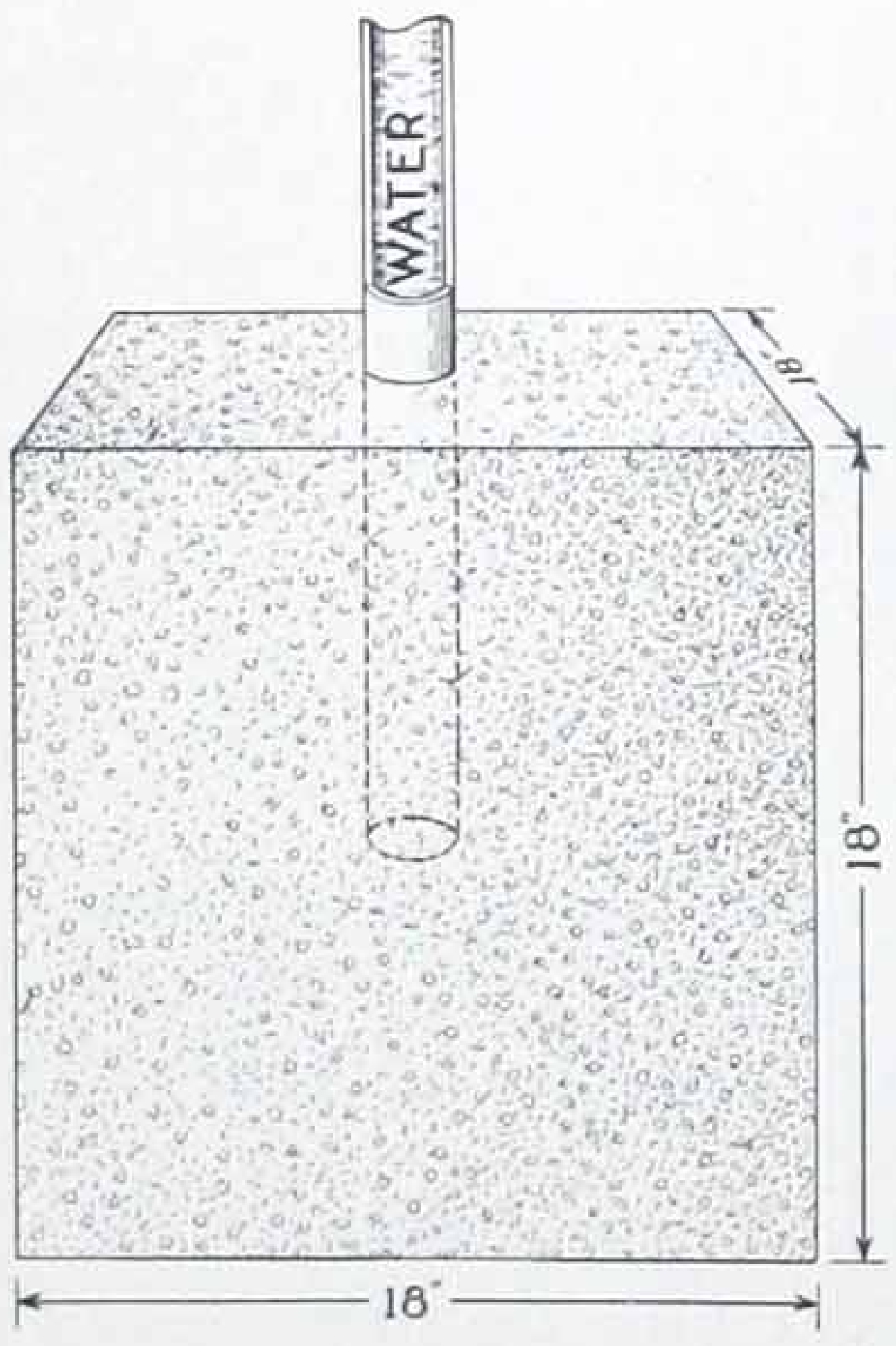
ROBERT W. HUNT & COMPANY
Chicago, Ill.

The General Fireproofing Building Products,
Youngstown, Ohio. March 8, 1921.

Gentlemen:—

Below we hand you, under Laboratory Nos. 11166 and 11167, results of permeability test on concrete to which GF No. 10 Integral Waterproofing Paste had been added in accordance with your letter of December 31, 1920. The Waterproofing Paste was furnished by you, under your Purchase Order No. 29747.

The specimen tested consisted of an eighteen-inch concrete cube having a two-inch diameter pipe imbedded in the center of one face to a depth of twelve inches, leaving a thickness of six inches of concrete between the face of the pipe and the opposite face. The mix for the concrete was one part cement, two parts Torpedo sand and four parts crushed stone, proportioned by volume. As it was specified, the minimum amount of water was to be used with which the concrete could properly be mixed and placed, it was accordingly mixed to a stiff pasty consistency. This required a mixing water (to which the Waterproofing Paste had been added), equivalent to 55.10% of the weight of the cement in the mix.



The Waterproofing Paste was added to the mixing water in the proportion of one part paste to thirty-four parts water. As the specific gravity of this paste is practically the same as that of water, it is possible to base the proportion either on the weight or volume.

After the test specimen had aged for twenty-eight days, the imbedded two-inch pipe was filled to the top with water and the specimen weighed. The specimen was then subjected to a thirty-pound pressure (which is equivalent to a head of 69.2 feet of water) continuously applied for a period of five days, after which it was disconnected and again weighed with the pipe filled with water. The specimen showed no damp spots on the surface, nor any appreciable increase in weight.

It was thereupon subjected to a sixty-pound pressure (which is equivalent to a head of 138.4 feet of water) continuously for five more days. At the end of this period, the specimen was again weighed and found to have had no appreciable increase in weight, nor were there any damp spots on the outer surface. The specimen was then broken open in a plane parallel to the length of the imbedded pipe to determine the depth of penetration of the water. An examination showed that the water had penetrated the concrete only for a depth of ¾" from the end of the imbedded pipe, as shown in the accompanying sketch.

The test specimen weighed 511 pounds before commencing the test and did not show any increase in weight amounting to as much as one-quarter pound, which was the smallest increment which could be weighed on our scales.

Respectfully submitted,
ROBERT W. HUNT & COMPANY.

Dictated by A. C. Scherer.

The quantity of water used in this test (55.10% of the weight of the cement used) was equivalent to about 6 gallons per bag of cement.

Method of Using GF 10

The quantity of water used for concrete varies considerably, generally being not less than 34 gallons per cubic yard. In Portland Cement plaster coat, floor finish and stucco work the quantity is generally three gallons per bag of cement. In cement blocks, tiles, artificial stone and similar work the quantity usually runs from 1½ to 2 gallons per bag of cement.

1⅓ lbs. (⅙ of a gallon) of GF 10 is sufficient to waterproof against *anv* hydrostatic head of pressure. Under favorable conditions, where there is no great or constant head of hydrostatic pressure, these quantities can be reduced as much as 25% and the GF 10 then used will develop sufficient water repellent lining in the pores to prevent the penetration of water by capillary attraction only.

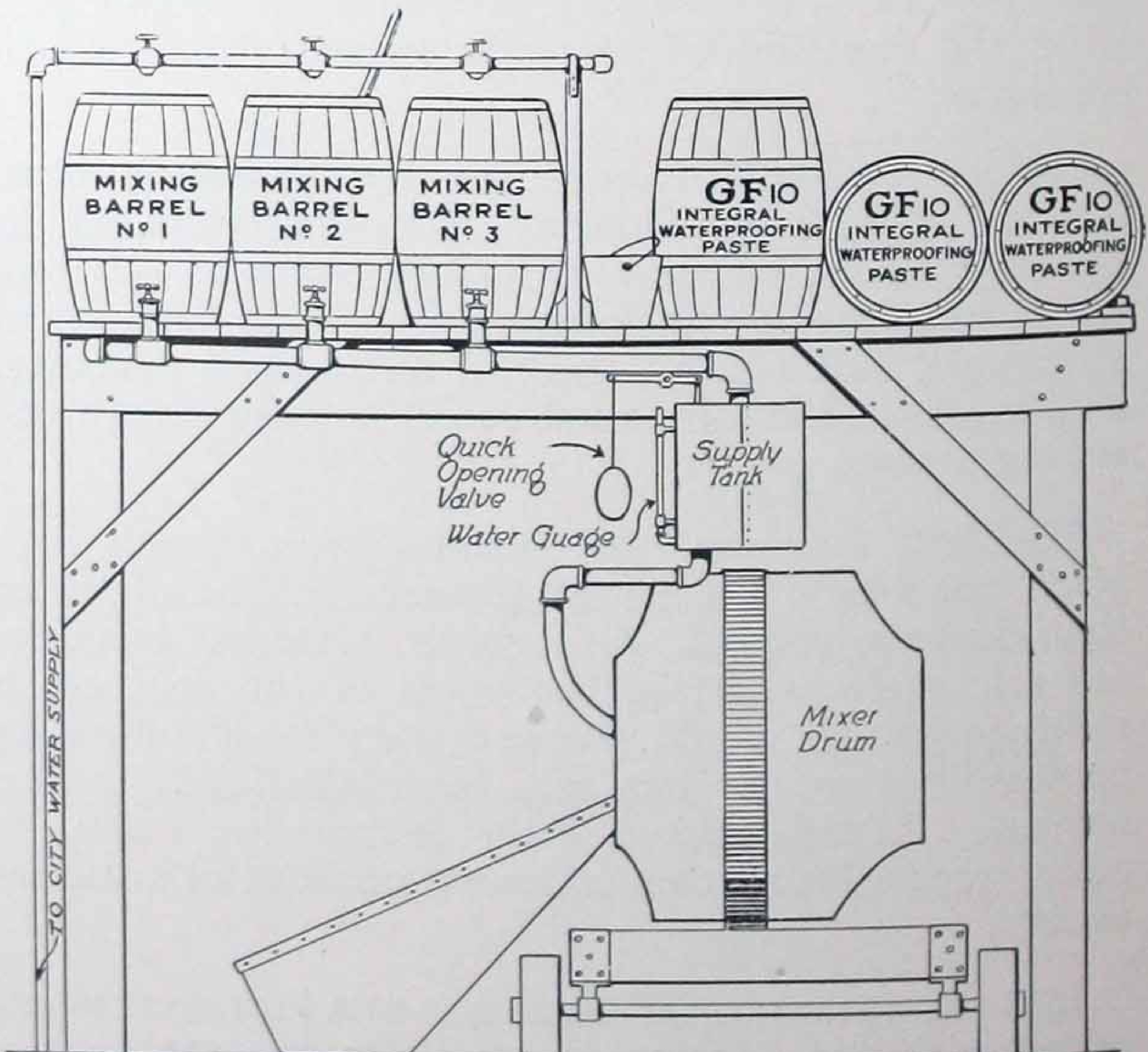
The simplest methods for obtaining the proper proportions of GF 10 and water are:

(*a*) For Mass Concrete

One gallon (8 lbs.) of GF 10 to 34 gallons of water. Into a 50-gallon barrel put 1½ gallons (12 lbs.) of GF 10, fill up with water and stir until it looks like a mixture of milk and water.

(*b*) For Cement Plaster, Floor Topping, Stucco or Cement Mortar

One gallon (8 lbs.) of GF 10 to 17 gallons of water. Put 3 gallons (24 lbs.) of GF 10 into a 50-gallon barrel then fill with water and stir as above.



(*c*) For Cement Blocks, Tiles, Artificial Stone

Determine the quantity of water to be used per bag of cement and make the solution of GF 10 and water on the basis of 1⅓ lbs. of GF 10 for each bag of cement.

(*d*) For a Mixer with Water Attachment

(1) If the water is supplied through a tank on top of the mixer, put one or more 50-gallon barrels on a platform slightly elevated above the top of the tank on the mixer, connect the water line to these barrels instead of to the tank and connect each barrel with a valve to the mixer tank. Make the solution of GF 10 and water in these barrels as described above and keep the mixer tank filled from the barrels.

(2) If the water is supplied directly to the mixer, make a barrel full of solution in the proportion of 1 gallon (8 lbs.) of GF 10 to each 5 gallons of water stirred as before directed. Put into the mixer 1 gallon of this solution for each bag of cement used in the batch and then immediately let in enough water to bring the batch to the usual consistency.

Note: These two methods *d*1 & *d*2 are applicable for either mass concrete, cement plaster, floor finish, stucco or mortar.

In some cases, as for instance in artificial stone and cement work where the least possible quantity of water is used, or in localities where the water contains lime carbonate and alkalies which will precipitate the GF 10 out of the water before it comes in contact with the cement, it is preferable to use a waterproofing medium in the form of a powder—GF 11—to be first mixed dry with the cement.

Shipping Data

Shipped in
8 lb. cans
40 lb. drums
240 lb. half drums
400 to 450 lb. drums
Shipping weight about 9¼ lbs. per gallon.
Net weight about 8 lbs. per gallon.

For quantities required see tables on page 77.

GENERAL SPECIFICATIONS FOR USING GF 10

These Specifications are to be observed carefully wherever GF 10 is used

FOR WATERPROOFING MASS CONCRETE AGAINST WATER PRESSURE FROM OUTSIDE AND INSIDE

1—Waterproofing

GF Integral Waterproofing Paste (GF 10), as manufactured by the Genfire Steel Co., Youngstown, Ohio, is to be purchased direct from them or their authorized agents. The paste must be brought to the building site in original and sealed packages. This paste must be used without adulteration and in accordance with the manufacturer's specifications and directions.

2—Cement

All cement shall be a high grade Portland Cement meeting satisfactorily the requirements of the Standard Specifications of the American Society for Testing Materials. It shall preferably be ground so that eighty per cent (80%) shall pass a standard two hundred (200) mesh sieve.

3—Sand

All sand shall be free from oils, loam, clay, vegetable or other deleterious organic matter and uniformly graded from coarse to fine in size.

4—Draining

Before actual waterproofing is begun, all water shall be drained away from surface to be waterproofed. Provision must be made to keep this water away during the process and until the last section of waterproofing is thoroughly set.

5—Materials

All concrete used in the (name part of work) is to be mixed in the proportions of one part cement, two parts sand and four parts aggregate. (Or one part cement, two and a half parts sand and five parts aggregate.)

6—Mixing

A dry mixture of cement, sand and stone is to be made, preferably in the proportion 1-2-4.

GF Integral Waterproofing Paste (GF 10) shall be added to the water, so that the proportion shall be 1 gallon (8 lbs.) of GF 10 to 34 gallons of water.

The dry mixture shall be tempered to a quaking consistency, using not more than 6 gallons of liquid per bag of cement.

7—Placing

All concrete is to be placed in one continuous operation where possible. Each pouring is to be thoroughly spaded to insure uniform density in the wall or floor.

8—Necessary Joints of New to Old Work

Where joints are absolutely unavoidable the old surface must be roughened all over with mason's chipping hammer; then thoroughly wire brushed, so that the surface shall be entirely removed to a depth of about ¼″.

After this has been done the face of the joint is to be treated with a solution made of 2 pounds of GF Bonding Compound (GF 400) dissolved in a gallon of water. This solution is to be applied with a corn broom or acid brush. After all chemical action has ceased the surface is to be thoroughly washed with clean water, using a hose if possible and then all the GF 400 and water removed entirely from the work.

While the surface of the concrete is still wet, a thin cream of cement and water is to be applied and the new concrete poured immediately.

9—Curing

The work is to be allowed to cure the ordinary length of time before the forms are removed.

FOR WATERPROOFING BASEMENTS, PITS, TANKS AND POOLS BY THE APPLICATION OF A WATERPROOFED CEMENT PLASTER COAT

Where waterproofing has been omitted from the concrete or where the necessity for it develops later, a perfect job of waterproofing can be done by applying to the interior surfaces of walls and floors a waterproofed cement plaster coat. This method may also be followed in the case of brick, stone or cement block walls.

For this class of work the cement plaster coat is waterproofed by the integral method, using one gallon of GF Waterproofing Paste (GF 10) to 17 gallons of water.

SPECIFICATIONS

Paragraphs 1 to 9 inclusive are to be followed carefully, and

10—Preparing Concrete Surfaces to Receive Waterproofing

The surfaces of concrete walls are to be thoroughly roughened with a mason's chipping hammer all over, so as to remove the entire face for a depth of about ¼'', then wire brushed and treated with GF Bonding Compound (GF 400) before any waterproofing is applied.

Two pounds of GF Bonding Compound (GF 400) are to be dissolved in a gallon of water. This solution is to be well rubbed into the surface with a corn broom or acid brush. After all chemical action has ceased, the wall is to be thoroughly slushed with a hose if possible, to remove all salts and loose particles resulting from the action of GF Bonding Compound (GF 400), and all the GF 400 and water entirely removed.

11—Preparing Brick or Stone Walls

The joints shall be raked out at least ⅜'' and then wire brushed to remove loose particles of mortar, and the faces of the brick or stone well chipped. Wire brush entire surfaces of walls and apply GF Bonding Compound (GF 400) as specified in Paragraph 10.

12—Preparing Floors

When topping and underbed are laid at the same time, the topping must be applied before the underbed has set. When underbed of concrete is set or the waterproofed coat is to be applied over an old floor, the surface must be thoroughly chipped so as to remove the entire face for a depth of about ¼''. All loose or hollow spots to be cut out and replaced with new concrete. GF Bonding Compound (GF 400) shall be used as specified in Paragraph 10 to ensure a perfect monolithic bond between the new and the old work. It is essential that the concrete floor to which the new waterproofed cement coat is applied be sufficiently strong to withstand the hydrostatic pressure from below (see tables, pages 78 and 79). If not, it will be necessary to ignore the old floor and to lay a new reinforced and waterproofed concrete floor on top, to which the new waterproofed cement coat shall be applied.

13—Materials

The mortar for the waterproofed cement plaster coat is to be mixed of not less than one part of cement to two parts sand nor more than one part cement to two and one-half parts sand. GF Integral Waterproofing Paste (GF 10) is to be added to the gauging water in the proportions of 1 gallon (8 lbs.) GF 10 to 17 gallons of water.

14—Mixing Quantities

The cement and sand are to be thoroughly mixed together dry. Then the water used for tempering this mass, in which has already been dissolved the GF 10, is to be added, using not more than 3 gallons per bag of cement and the whole thoroughly mixed until it is of even consistency.

15—GF 14 Ironcote Wash

All surfaces to be saturated with as much water as they will absorb and directly afterwards a wash composed of GF 14 Ironcote mixed with water to the consistency of a thick paste is to be well brushed into the surface.

16—Scratch Coat

Immediately after the Ironcote wash has been put on, the first (scratch) coat of waterproofed cement plaster shall be applied and brought to a fairly smooth and level surface.

Scratch coat shall be about ⅜'' thick and after it has obtained sufficient set it is to be thoroughly scratched to afford a key for the second coat. Care should be taken that the scratching does not penetrate the entire depth of the scratch coat and that more scratch coat is not applied at one time than can be covered with finish coat the next day.

17—Finish Coat

Not more than 24 hours later the second (finish) coat of waterproofed cement plaster shall be applied. This coat shall be floated free from all imperfections, using the greatest pressure possible for the workmen to apply. Then the surface is to be finished to a smooth, even texture with a steel trowel.

The total thickness of the two coats should not exceed ¾''.

(Note—In case it is not necessary to apply a waterproof cement plaster coat over the floor, a narrow gutter 2½'' deep by 3½'' wide should be cut down into the floor, close up to the wall, treated in the same manner as the side walls as specified in Paragraphs 10 and 15 and filled with cement plaster which is to be troweled out and up to an even surface with the surrounding flooring. This to be put in simultaneously with the finish coat on the walls.)

18—Caution

All pipes or other conduits extending through the walls to be waterproofed, shall be painted thoroughly with a coat of GF Brush Coating (GF 16) before the waterproofed cement plaster coat is applied.

19—Top Finish over Floor

After all traces of grease, dirt and other foreign matter have been carefully removed, the surface of the floor shall be treated in accordance with Paragraphs 10 and 15.

Idora Park Swimming Pool, Youngstown, Ohio. Consulting Engineers, Lynch Bros. New Haven, Conn. Contractors, The Heller-Murray Company, Youngstown, Ohio

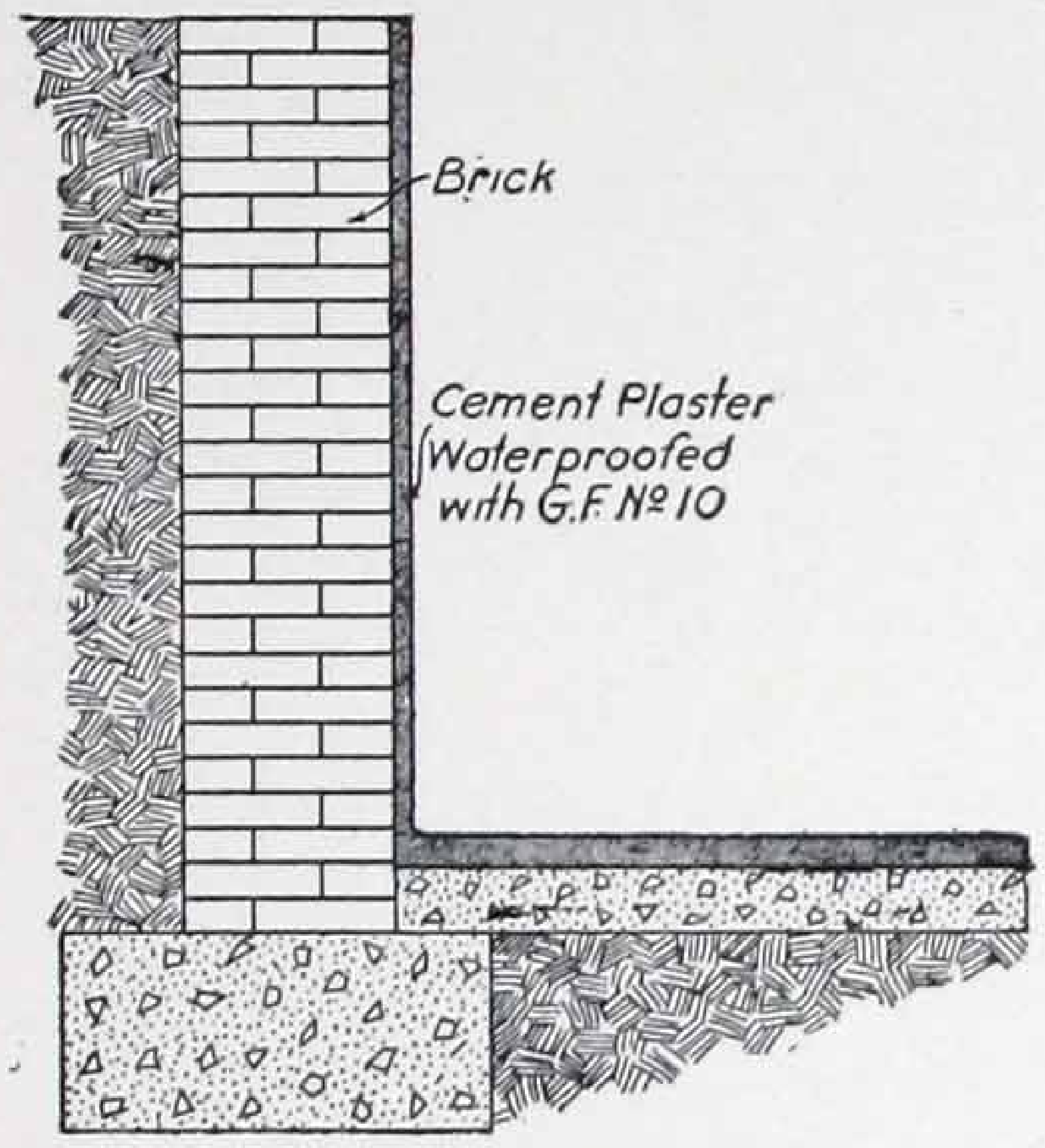
The cement plaster coat for 6 inches up the walls from the angle of the walls and floor shall be roughened and treated with GF Bonding Compound (GF 400) for the reception of the floor waterproofing so as to obtain a perfect bond and tight joint at this point.

The waterproofing over the floors shall be carried up this wall waterproofing in the form of a coved base for a distance of about 6″.

All encumbrances upon the floor that cannot be removed or any pipes extending through the work to be waterproofed shall be painted with GF Brush Coating (GF 16) to form a flexible joint with the waterproof coat over the floor.

The waterproof mortar is to be applied in one coat to a thickness of at least 1″, preferably 2″, and carried up all walls in the form of a base 6″, above the general level of the floor.

After this mortar has obtained sufficient set, it is to be floated free from all imperfections and trowelled smooth with a steel trowel. In the course of this floating and in the trowelling, as much pressure as possible must be exerted to finish the surface free from imperfections.



20—Joints

This floor to be laid without joints.

Watertight joints in walls or floors between each day's work to be obtained by working up to a wood strip of the desired thickness; next day remove this strip, break back the edge for a distance of about 1″, treat the new edge with GF 400 and Ironcote wash as before described in Paragraphs 10 and 15, and lay the new finish well up to this edge taking special care in floating and trowelling such joints to prevent later opening or cracking.

The waterproofed cement coat to be continuous over all floor surfaces, walls, pits, trenches, etc. under and behind all abutting walls and partitions, and columns. If it cannot be carried under and behind walls, partitions or columns, then it must be carried up on all sides of same from floor to grade level.

21—Pumping

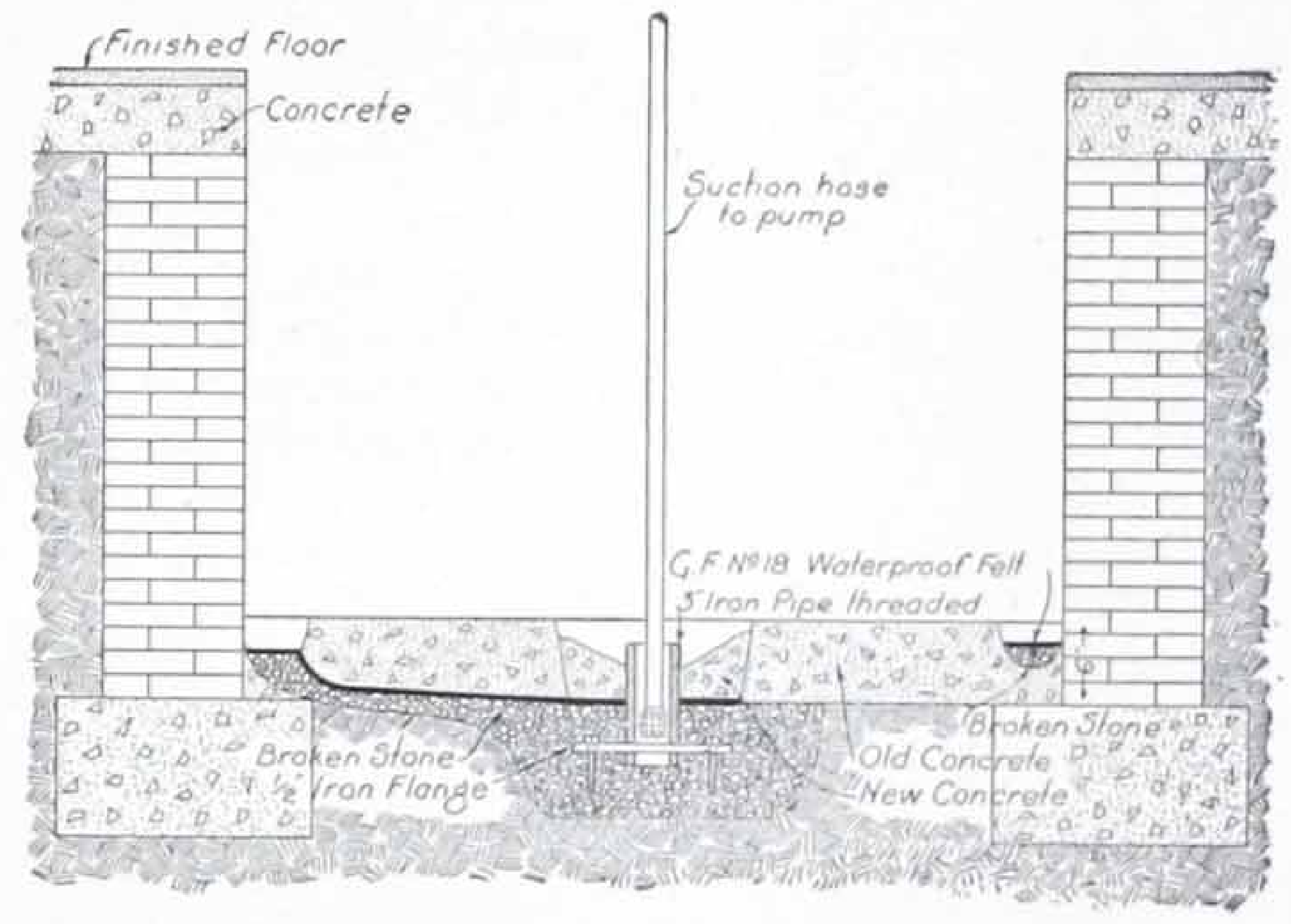
In cases of continual water pressure the work is to be kept clear of water by pumping continuously during the progress of the work and until the waterproofed cement coating has set dry, white and hard.

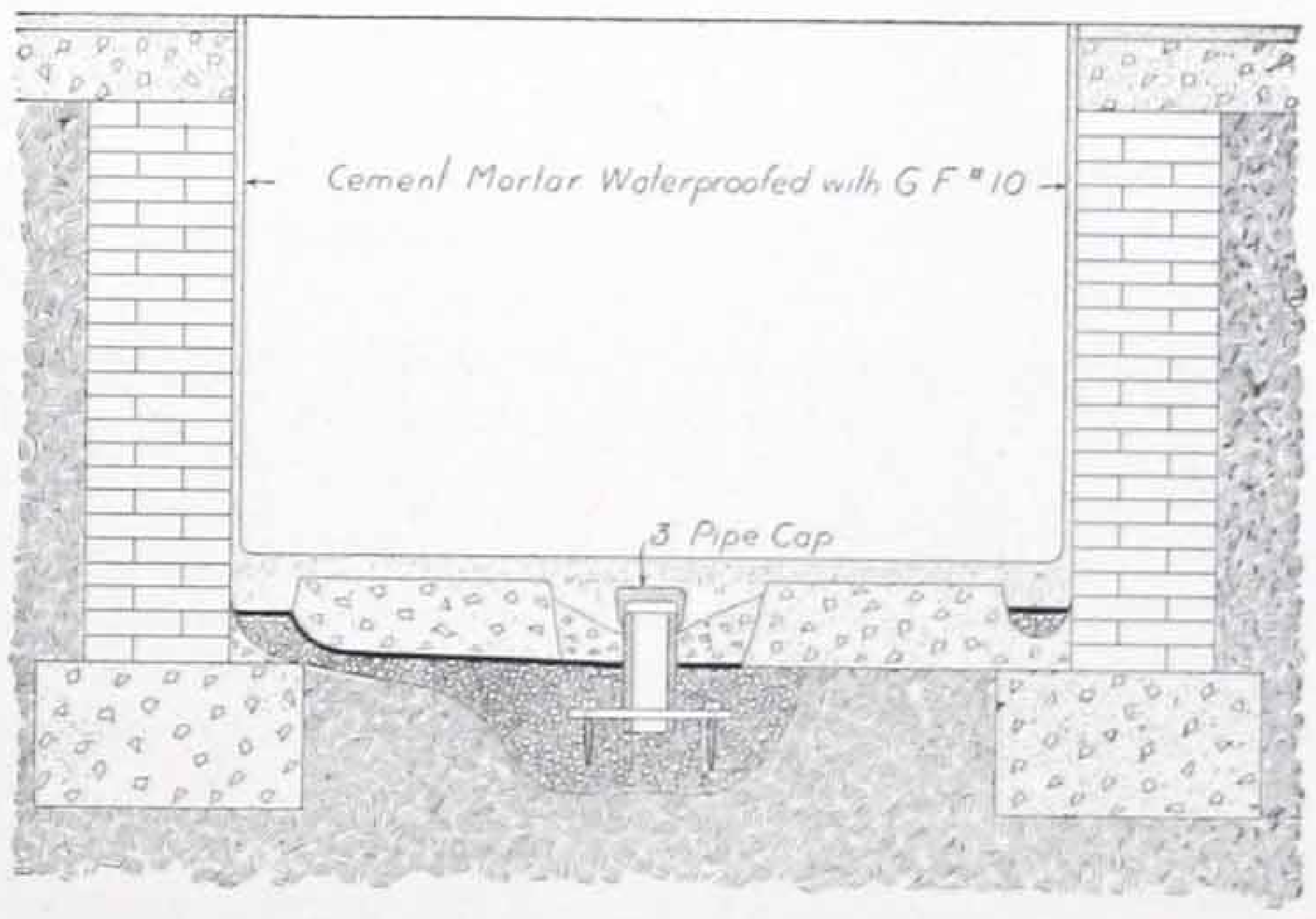
This is best done by locating the pumphole outside the walls. In cases where this is not possible it should be located in the middle of the floor and made 12″ deep, below the underside of the concrete floor. Occasionally this may not suffice to keep the water from coming up through the floor or through the walls. In such case, cut a drain in the floor all around the walls about 6″ deep and 3″ wide, conducting it across the floor to the pumphole. This drain to be filled with broken stone or gravel and covered with a layer of dry tar paper to prevent choking up by the installation of the waterproofed cement coating. If water comes through the walls, cut slots in the wall about 1″ deep and 1″ wide leading down into this drain. When applying the cement plaster coating over these slots and drains, incorporate into the finish a piece of expanded metal lath about 4″ wide to reinforce the cement coating against cracking.

Into the pumphole insert an unpainted cast iron pipe of sufficient diameter to take the suction pipe of the pump. This cast iron pipe to have an iron flange at the lower end drilled to take four 4″ iron bolts to hold the pipe in place and prevent twisting. The top of the pipe to be threaded to take an iron cap which is to be screwed on when the waterproofing is completed. This pipe to be set in the pumphole so that the top of the cap will be 2″ below the finished floor level. The bottom of the pumphole to be filled with broken stone to support the flange, and the pipe tightly packed with broken stone, the floor waterproofing to be finished up to a wood frame around the pipe.

After floor is thoroughly set, remove wood frame, treat edges of floor waterproofing with GF 400 and Ironcote wash as before specified. (Par. 10 and 15). Pump water as low as possible, remove pump, screw cap over pipe and fill over with waterproofed cement mortar the same as the rest of the floor, taking special care in well floating and trowelling the joint. A piece of board to be laid over this and well weighted to keep it in position until the new mortar has thoroughly set.

In cases where the water pressure is not very great or the water rises slowly, the iron pipe can be omitted and pumping done from a hole left just large enough to take the suction pipe. Finish the floor waterproofing up to a wooden frame as before specified; when ready to close the pumphole, remove this frame, treat edges of floor waterproofing with GF 400 and Ironcote wash; pump water as low as possible, remove pump and fill hole to within 2″ of the top with a mixture of soda ash and cement 1 to 1 slightly dampened with water. Tamp tightly into hole and cover immediately with waterproofed cement finish floated and trowelled and weighted down as before specified. Another quick setting cement that can be used for temporarily plugging seepage of water thru a wall or floor, can be made as folows:—





1 lb. Litharge mixed dry with ½ lb. of Soda ash, 1 pint of glycerine mixed with 1 pint of Sodium Silicate. Add enough glycerine and sodium silicate mixture to the litharge and soda ash to make a plastic mass and force rapidly into place as the mixture will set almost immediately.

WATERPROOFED CEMENT PLASTER COAT APPLIED ON OUTER FACE OF AND UNDER WALLS AND OVER OR UNDER TOP OF FLOORS

Paragraphs 1 to 9 inclusive and 10 and 15 are to be followed carefully, and

22—Treatment of Footings

After the footings have been set in place and while they are still green, a 1″ coat of waterproofed cement mortar shall be plastered over the top of them. This waterproof coat shall be carried either side of the wall line the full width of the footings and well scratched beyond the wall lines.

23—Treatment of Walls

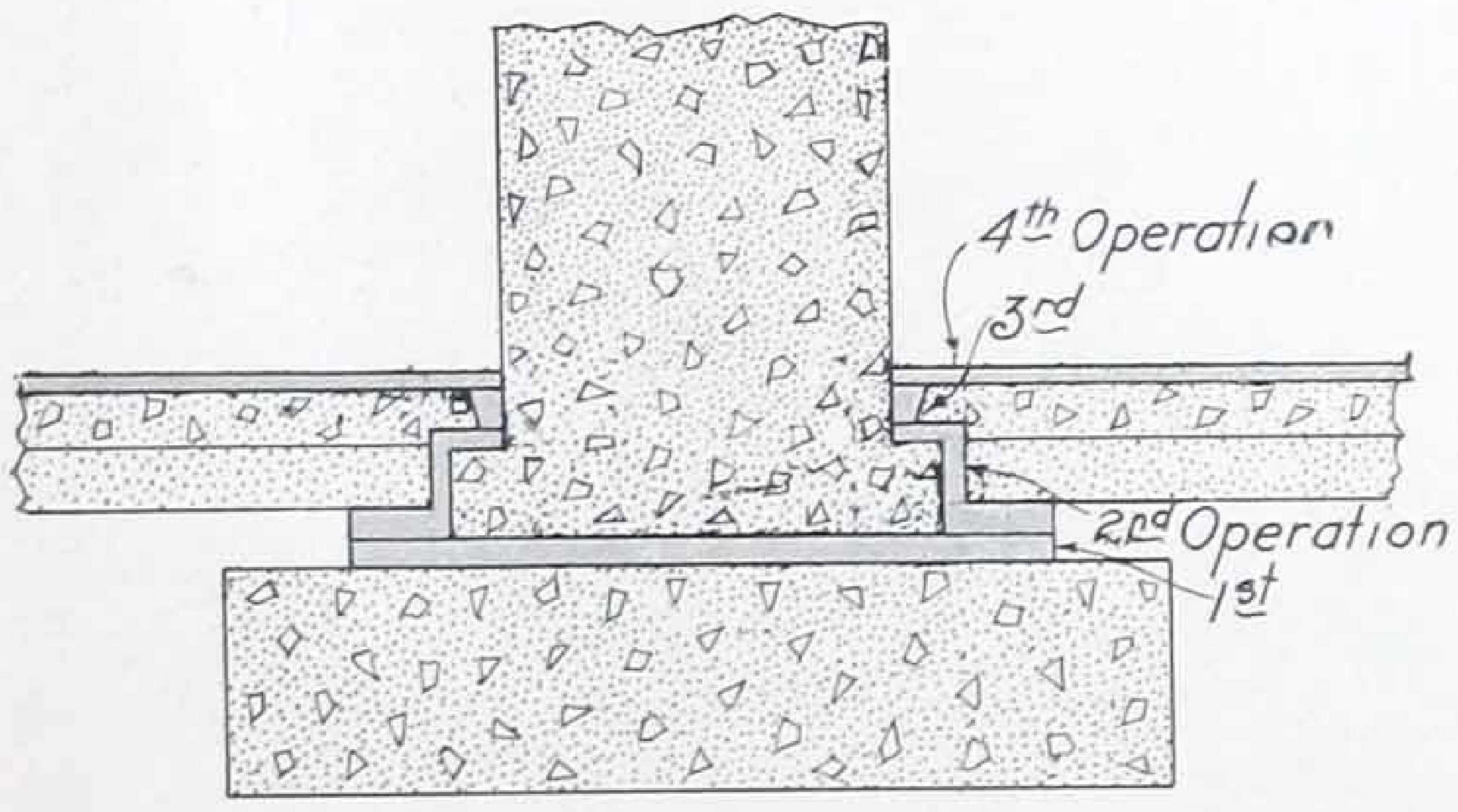
After the side walls have been roughened, treated with GF 400 and saturated, and while the surface is wet, apply Ironcote wash and immediately plaster the first coat of waterproofed cement plaster onto the wall from the top of the footing up to 1″ to 3″ above grade. The first coat should be about ⅜″ thick and should be thoroughly scratched to afford a key for the second coat. The second coat to be applied not more than 24 hours later and to be well floated and trowelled to a dense, smooth finish.

24—Back Fill

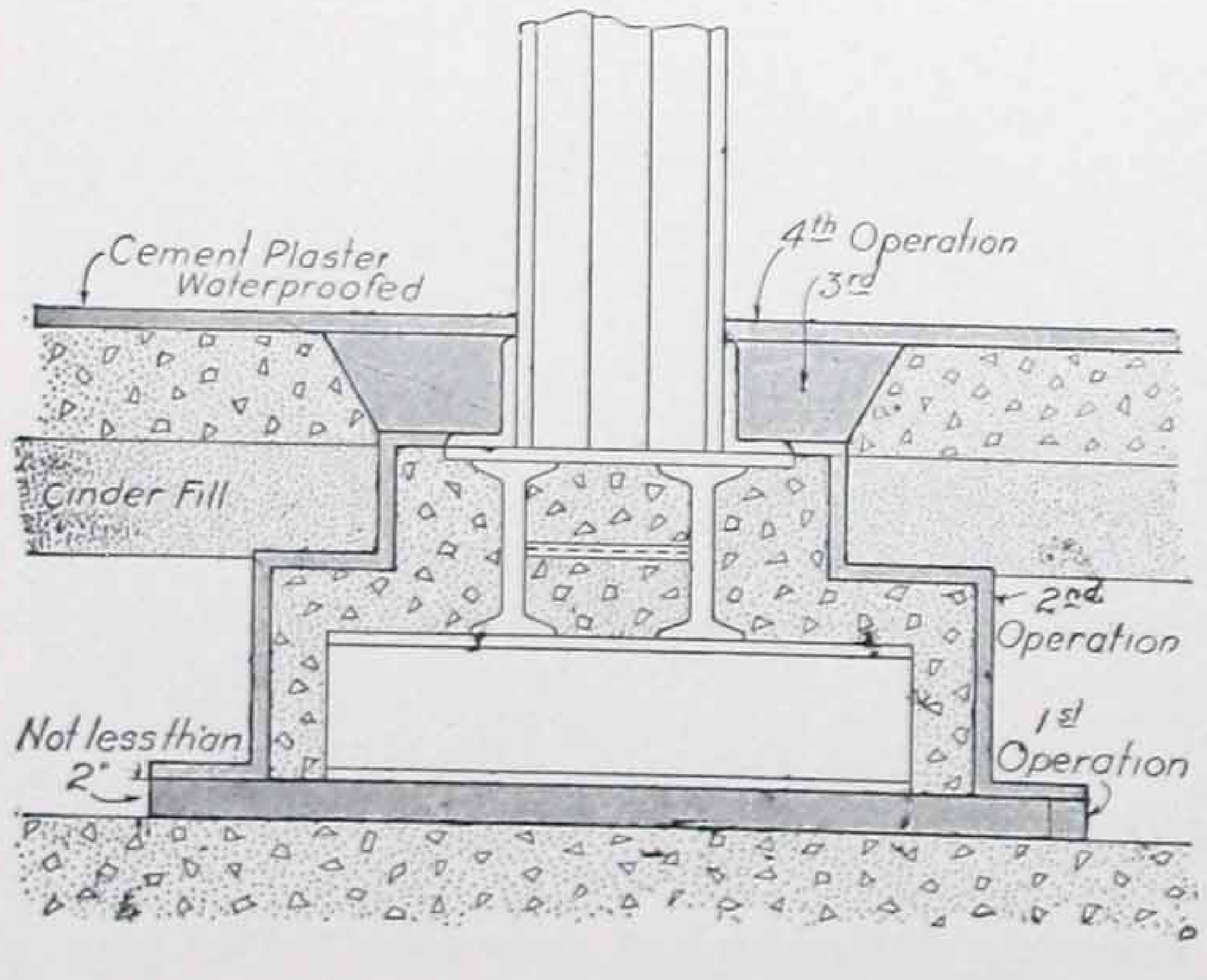
After the second coat of waterproofed cement mortar has been applied and thoroughly trowelled up, the back fill may be done directly against this plaster coat.

25—Joint at Footings

The laps on either side of the walls shall be treated with GF 400 and Ironcote wash as before specified (Par. 10 and 15) to afford perfect bond for floor and outside wall waterproofing.



Waterproofing Footing for Concrete Column with GF No. 10

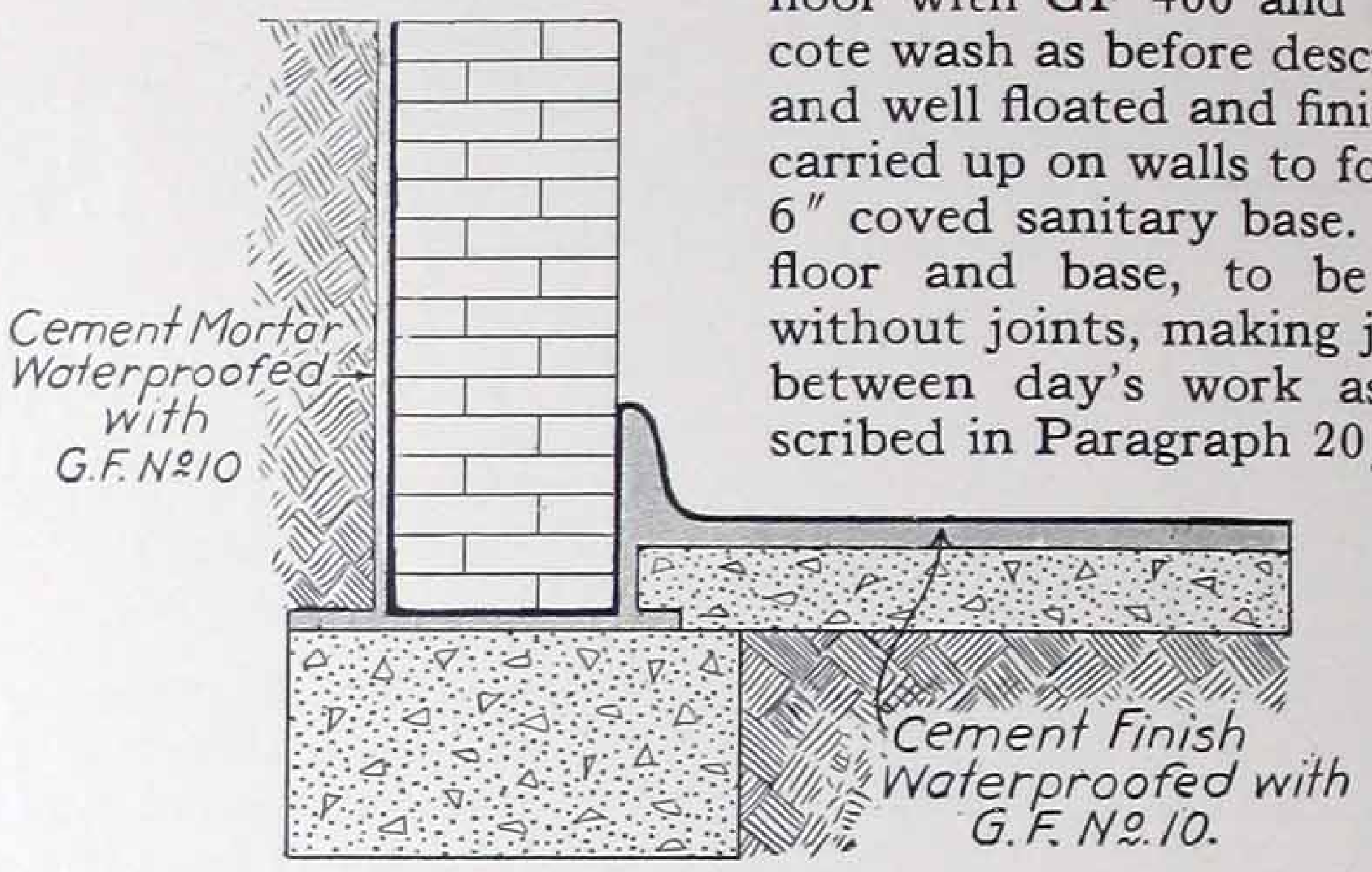


Waterproofing Steel Column Footing and Grillage

26—Joint at Floor

Before the concrete floor is laid a waterproofed cement plaster coat applied as specified for the outside of the walls, shall be carried from the top of the footing to a point 6″ above the surface of the finished floor inside.

Cover floors with waterproofed cement firmly bonded to floor with GF 400 and Ironcote wash as before described and well floated and finished, carried up on walls to form a 6″ coved sanitary base. The floor and base, to be laid without joints, making joints between day's work as described in Paragraph 20.


Cement Mortar Waterproofed with G.F. No10
Cement Finish Waterproofed with G.F. No. 10.

WATERPROOFING SWIMMING POOLS, TANKS, ETC., BY THE PLASTER COAT METHOD

Paragraphs 1 to 9 inclusive and 10 and 15 are to be followed carefully, and

27—Connecting Drains

All inlet pipes, outlet pipes or floor drains are to have copper flashings, extending at least 6″ from the side of and soldered firmly to the pipe or drain, this flashing to extend at right angles from the pipe or drain into the concrete.

This flashing shall be painted with two thorough coats of GF Dampproof Coating (GF 200), or GF Foundation Brush Coating (GF 16), in order to give a flexible joint between the concrete and flashing.

28—Tile or Brick Lining

Before the tile or brick lining is put in, the surface of the concrete is to be thoroughly chipped in order to afford a bond for the mortar used in setting.

The mortar used in setting the tile or brick is to be waterproofed with GF Integral Waterproofing Paste in the proportion of 1 gallon of GF 10 to 17 gallons of water.

29—Cement Plaster Coat, Waterproofed

A cement plaster coat at least ¾″ thick is to be applied to the side walls and floor of the pool. The mortar used for this cement plaster coat to be composed of one part cement, two parts clean, sharp sand. This mixture to be tempered to proper working consistency with water to which has been added GF 10 in the proportion of 1 gallon of GF 10 to 17 gallons of water.

The final coat of mortar is to be scratched, as soon as it is set up sufficiently, in order to afford a mechanical bond for the mortar used in setting the enamel brick or tile lining.

(Note—In case no brick or tile lining is to be used, the surface of the finish coat is to be trowelled smooth with a steel trowel.)

30—Platform Around Pool

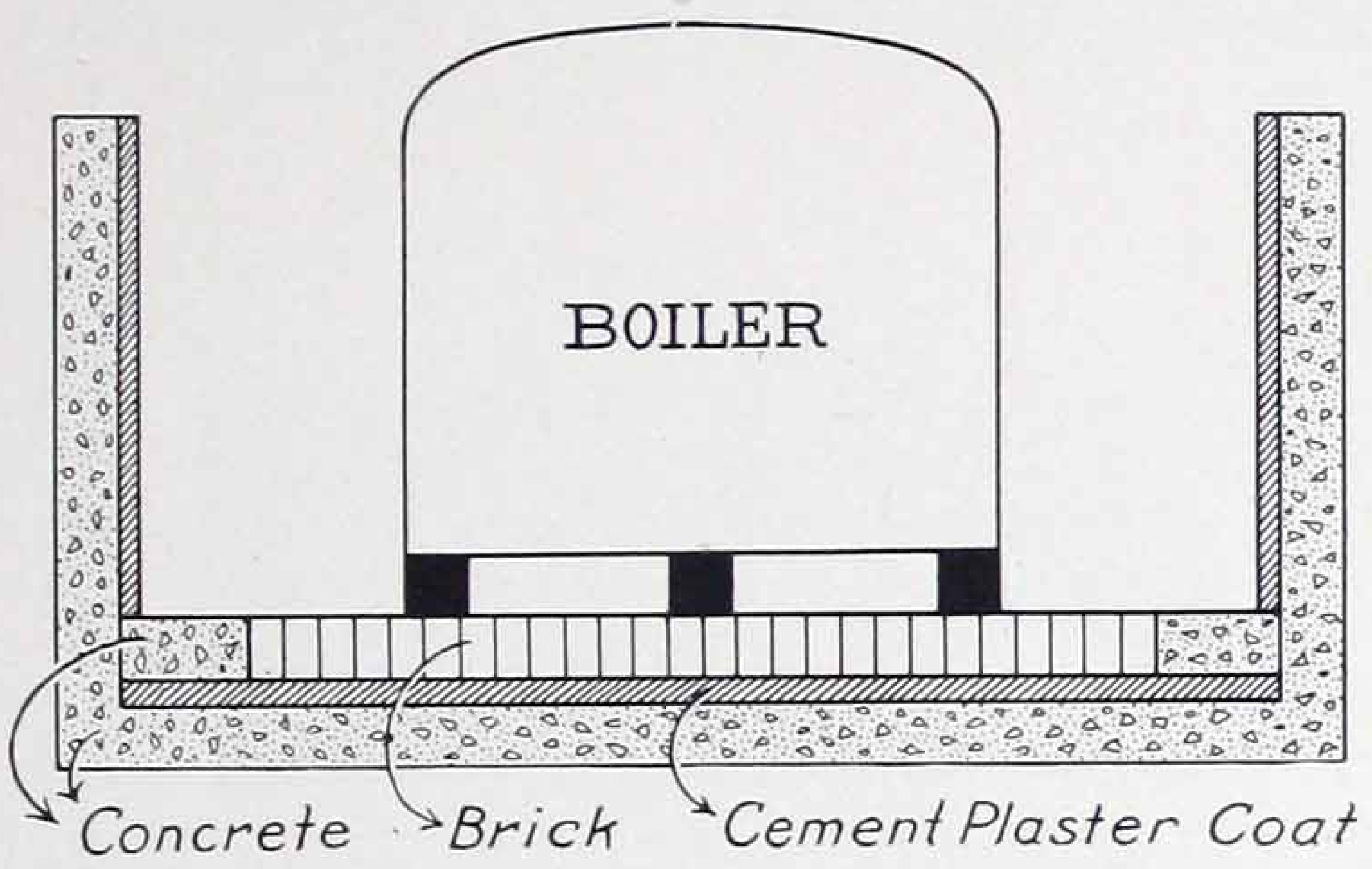
The cement plaster coat is to be carried through the gutter up and over the platform surrounding the pool, and up the walls surrounding this platform to form a 6″ base.

WATERPROOFING BOILER PITS

Paragraphs 1 to 9 inclusive and 10 and 15 are to be followed carefully, and

31—In Case of Excessive Water Pressure

Walls and floors should be relieved of pressure as indicated in Paragraph 21. The same method of waterproofing for boiler pit shall be followed as in case of an ordinary pit or basement, except that directly underneath the boiler a course of fire brick shall be laid, same to extend at least 2′ on each side of the boiler and 4′ in front of the boiler, as shown by detailed illustration herewith. This will prevent hot coals from burning out and destroying the waterproofing course.



Method of Waterproofing Boiler Pits

BREAK OR OPENING IN SURFACES WHERE CONCRETE IS WATERPROOFED BY THE INTEGRAL OR PLASTER COAT METHOD

Sometimes a break occurs in a wall or floor that has been waterproofed by the Integral Method, either in the mass or by a plaster coat, because of the settlement of the building, defective workmanship, the removal or placing of pipes, or external damage. This can be repaired in the following manner.

32—Large Break or Opening

In case the break admits either a single large stream or several small streams of water, remove the entire area of the affected surface to a depth of ¾″, leaving the surface rough.

Paragraphs 1 to 9 inclusive and 10 and 15 are to be followed carefully, and

33—Bleeding

Provide several pieces of ¼″ iron pipe (two or three inches in length) and drive one piece into the surface wherever water enters, leaving the end projecting about ¼″ beyond the roughened surface. After the pipes are all placed, the water will enter only through the pipes.

34—Application

After the wall is thoroughly saturated and cleaned with GF 400, apply over the whole of the affected area a coat of Ironcote wash and then two coats of Portland Cement Mortar, as specified waterproofed with GF 10, finishing the surface flush with the old adjoining surface.

After this coating has thoroughly set and dried, plug up the ends of the bleeders (pipe) with a piece of wood driven in tight. Then cover with cement mortar, connecting this mortar to the adjoining cement coating, using GF 400 and Ironcote wash as specified in Paragraph 15.

Only a few of the "bleeders" are to be plugged daily, working from the outside to the center of the space, allowing sufficient time for the newly applied cement plaster coating to set hard before closing any more "bleeders." The last "bleeder" is plugged and waterproofed in the same manner as the others and immediately covered with wet straw boards firmly braced and kept wet until the cement plaster coating has set.

35—Small Break or Opening

If the break is small, clean the surface of all loose particles of cement, dirt, etc., and treat with a liberal application of GF 400 and Ironcote wash. Apply over the surface two coats of Portland Cement Mortar waterproofed with GF 10. Both coats must be worked well into the edges of the old plaster coating. After this is done, cover immediately with wet straw boards firmly braced to position, and kept so until the plaster coat has set.

36—Crack

If the leak or opening takes the form of a long crack, and there is considerable water coming through it, the best method to pursue is to cut an inverted key into the wall, treat the sides of this key with GF 400 and Ironcote wash, and then fill key full of mortar waterproofed with GF 10 as specified for other plaster coat work.

After this mortar has been tamped in as firmly as possible, it is to be braced with wet straw boards covered with planks. These are to remain in position and kept wet for several days until the mortar has set thoroughly.

JOINTS OF BRICK, STONE OR TILE WORK—GF INTEGRAL WATERPROOFING PASTE (GF 10) INCORPORATED THROUGH THE MORTAR

Paragraphs 1 to 6 to be followed carefully, and

37—Material

The mortar for the joints is to be composed of one part cement to two and half parts sand. In either case GF 10 is to be added to the water used in mixing this mortar, in proportion of 1 gallon GF 10 to every 17 gallons of water.

38—Mixing

The cement and sand are to be thoroughly mixed together. Then the water, in which has already been dissolved the GF 10, is to be added using not more than 3 gallons of this water per bag of cement and the whole thoroughly mixed until is is of even consistency.

39—Brick Wall

All brick shall be thoroughly wet just previous to being laid, except in freezing weather, when they shall be thoroughly dry. The brick shall be laid with full beds and joints properly and solidly bonded. No mason work of any description shall be built when the temperature is below 28 degrees F. on a rising temperature or 32 degrees F. on a falling temperature, at the point where the work is in progress. No frozen materials shall be built upon in any case.

40—Stone Wall

All stone shall be laid on their natural bed. No stone which does not bond or extend into the wall at least 6″ shall be used.

Stones shall be firmly bedded in mortar of the same mixture as specified for brick walls, and all spaces and joints shall be thoroughly filled with like mortar.

41—Application

The brick or stone are to be laid in the usual manner except that great care must be taken to see that all beds and joints are full and continuous.

The faces of all joints must be struck off true with a trowel so as to leave no holes or seams.

Great care must be taken to fill entirely around all pipes, etc., breaking through the wall. In addition, all these pipes must be painted with GF 200 to form a flexible joint.

42—Flat Tile Roof

The bed of mortar in which the tile are laid is to be at least 1″ thick, made after the proportion hereinbefore specified.

43—Laying Tile

The tile are to be embedded in this mortar and trued up, leaving at least a ⅜″ joint between all tile.

44—Pointing

The pointing mortar is to be made of the same proportion as that for the bed. The joints must be thoroughly filled and mortar well trowelled down so as to leave no holes or voids.

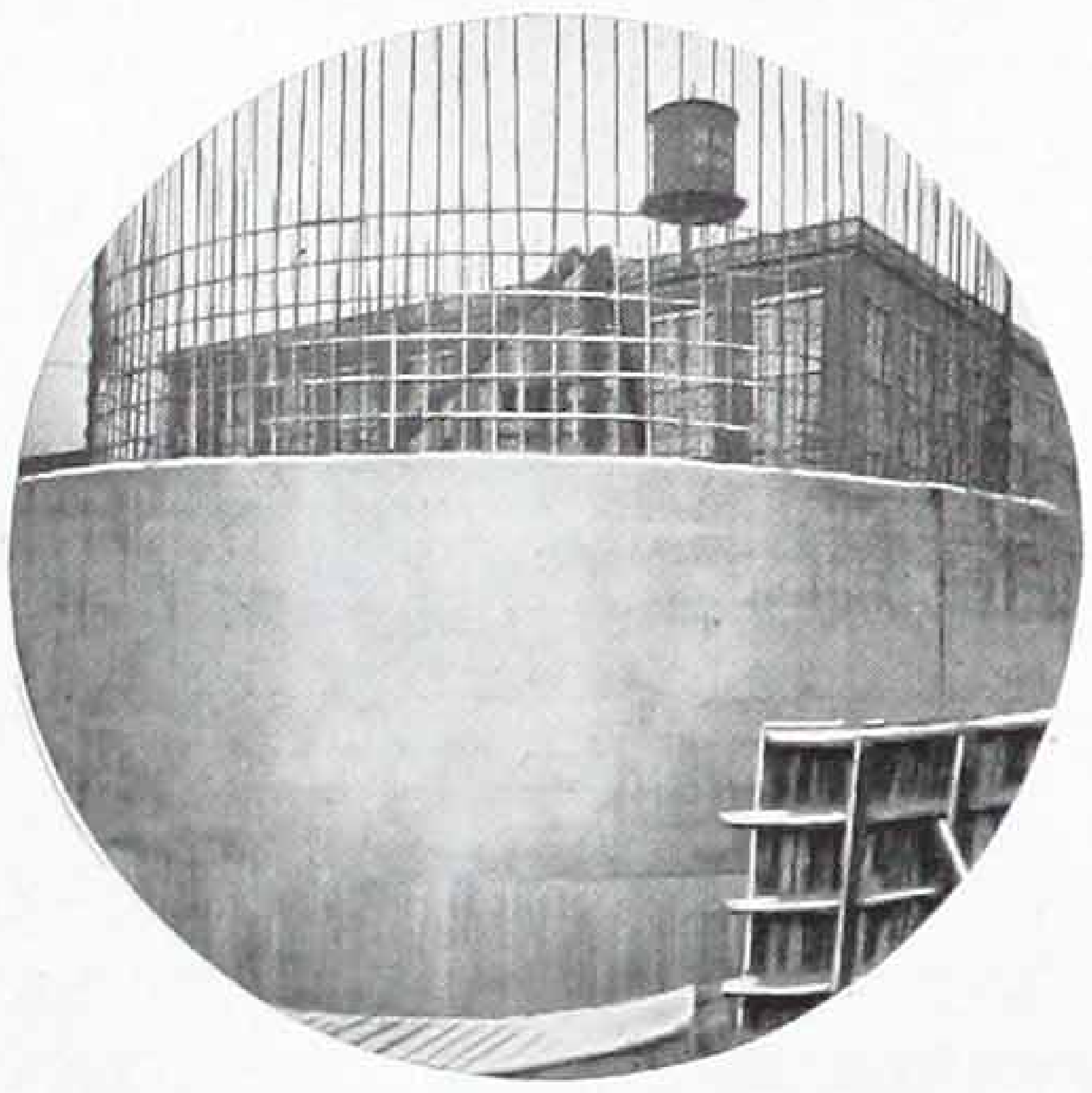
45—Grouting

The grout is to be made of the same proportion as above specified, except that additional water, containing GF 10 in the proper proportion, is to be used to render the mixture sufficiently liquid to pour into these joints.

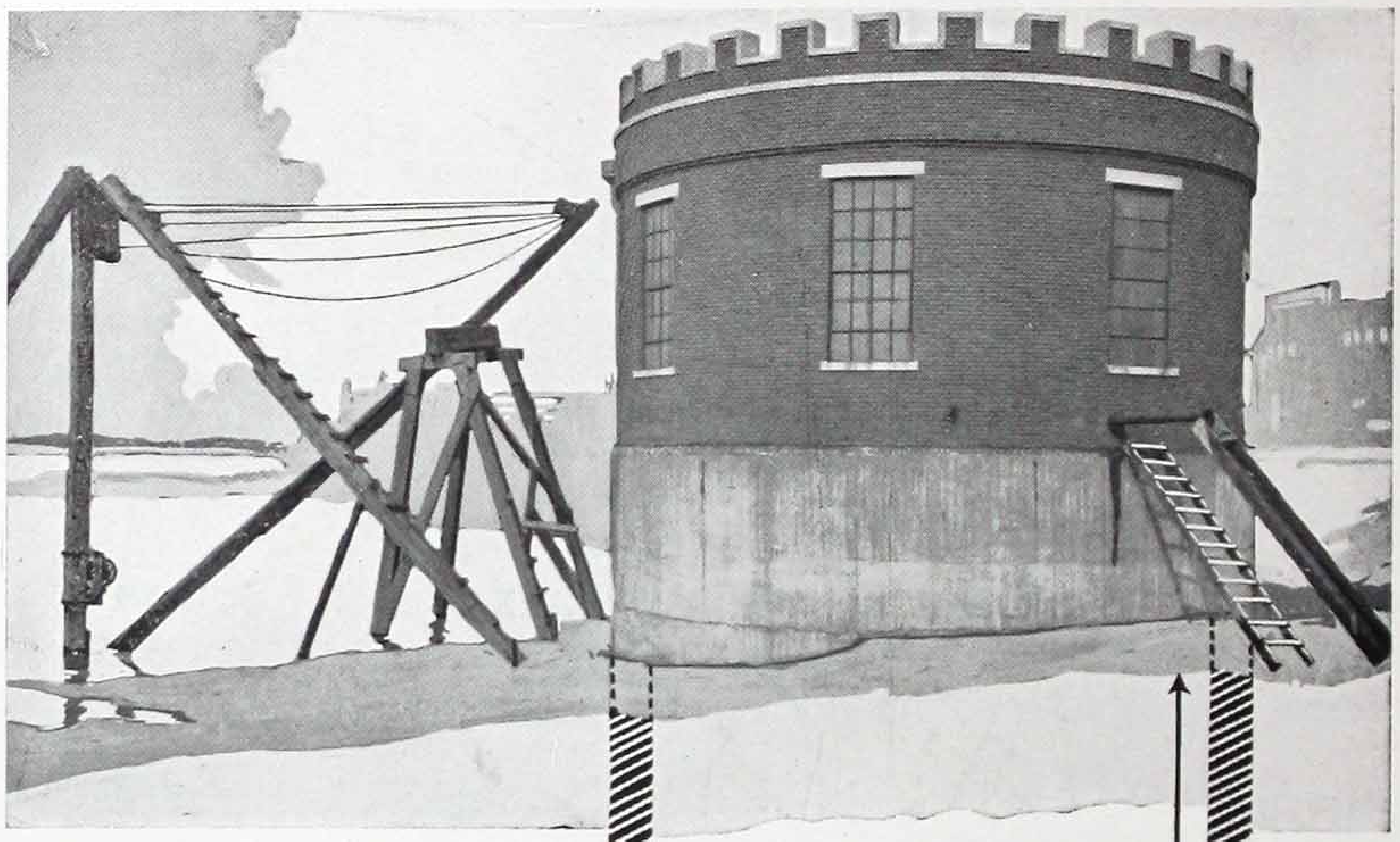
All joints shall be filled flush with the surface and the grout be so poured that no air is imprisoned in the joints.

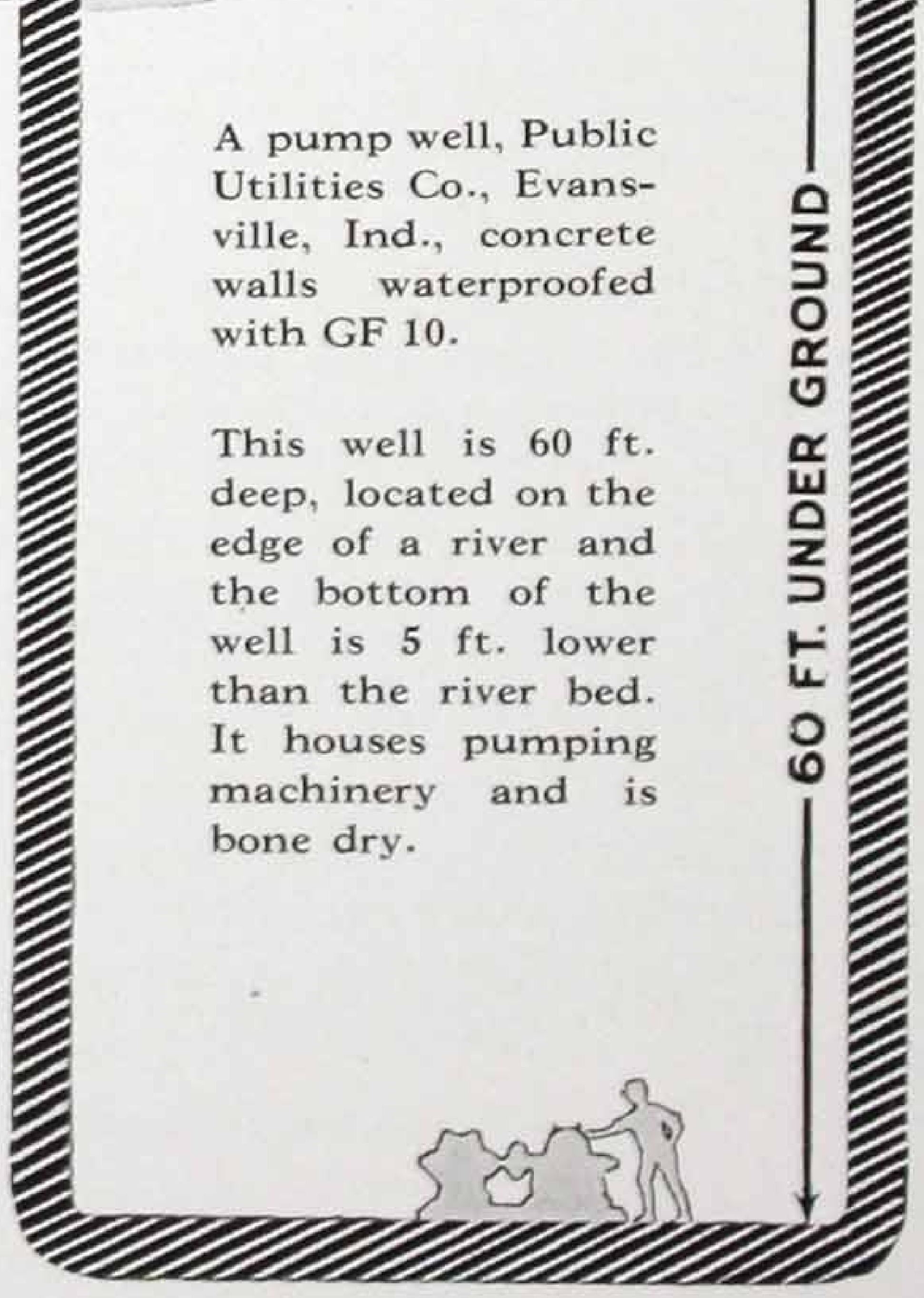
46—Pitched Roof

The mortar used in pointing the joints of tile (joints to be not less than ⅜″ wide) is to be of the same proportions as hereinbefore specified, applied in accordance with directions in Paragraph 44.



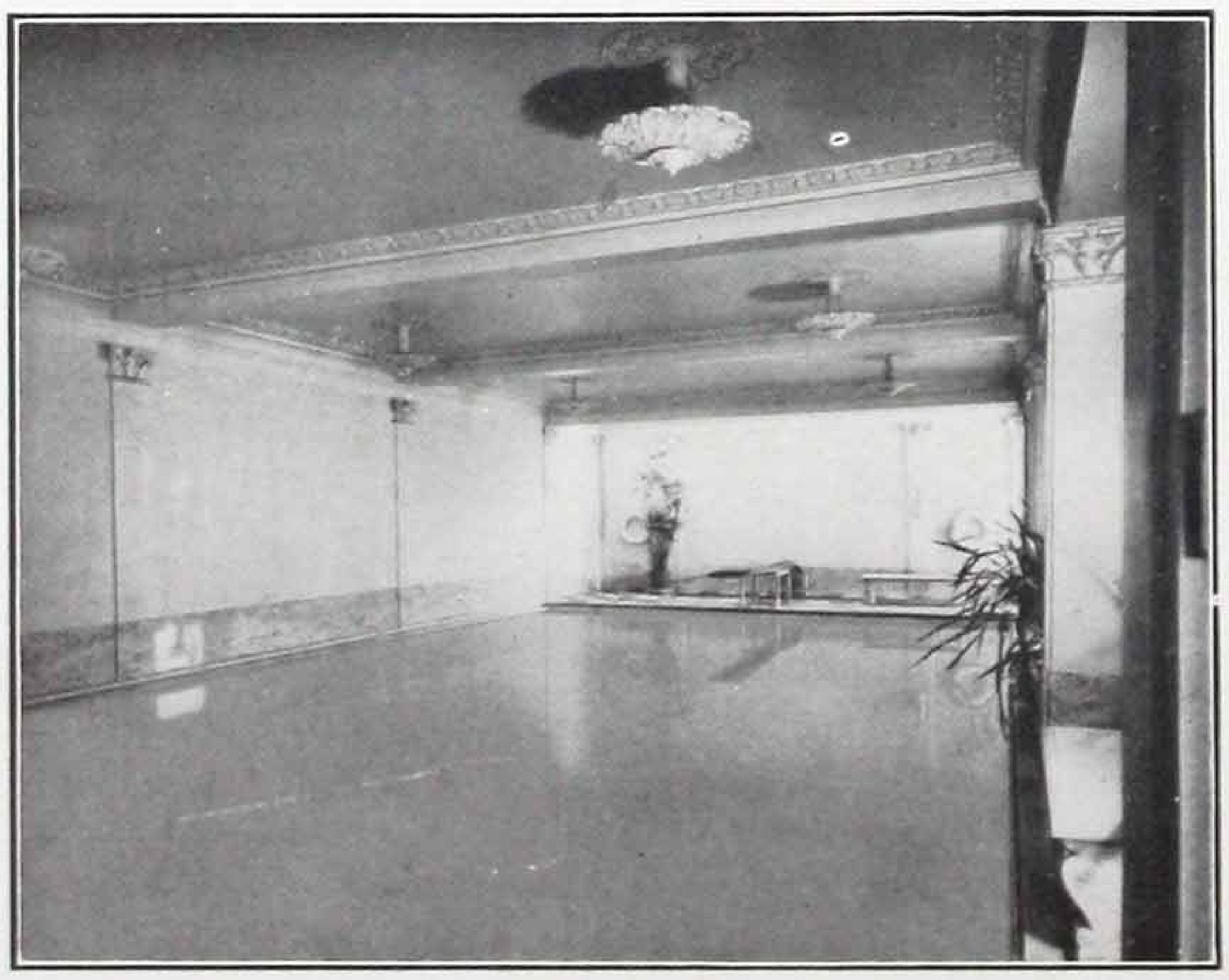
Evansville Public Utilities Co.
Well under construction





A pump well, Public Utilities Co., Evansville, Ind., concrete walls waterproofed with GF 10.

This well is 60 ft. deep, located on the edge of a river and the bottom of the well is 5 ft. lower than the river bed. It houses pumping machinery and is bone dry.



Swimming Pool, Woman's Athletic Club, San Francisco, GF 10 used. Bliss and Faville, Architects

WATERPROOFING AND DAMPPROOFING STUCCO INTEGRALLY USING GF 10

Portland Cement stucco, like all other exterior masonry, is preserved by being weatherproofed. Where stucco is applied over wood lath or tile, it is always well to waterproof the stucco in order to offset in a measure the tendency of the stucco to become streaked or mottled due to the unequal absorption of water.

While the use of Metal Lath will prevent the streaked and mottled appearance of the stucco and give a uniform and pleasing finish, still it is advisable to waterproof the stucco in order to prevent disintegration due to water seepage and subsequent chemical or frost action. Also to prevent staining and discoloration due to the carrying of dirt, soot, etc., into the surface by absorption of rainwater.

The absorption of water is one of the causes of the checking or crazing of stucco surfaces. Water causes cement itself to expand very considerably, even after it has what is called "set," and will continue to exert this action upon it for a number of years, see article by Professor Alfred H. White of the University of Michigan in "CONCRETE", May, 1925, page 157. This expansion of the cement generally in the mass, causes fine cracks both on the surface and thruout the thickness of the stucco.

Water causes the disintegration of cement by the mechanical forces of the crystallization of almost any salt or alkali in the pores, as explained in Technologic Paper No. 12, United States Bureau of Standards, by Bates, Phillips and Wigg, also Reinforced Concrete and Masonry Structures, by Hoole & Kinne 1924, page 146, also the report by P. F. Freeman and John Ferguson of the United States Bureau of Standards, 20th Convention Proceedings of the American Concrete Institute, 1924.

The Report of the British Research Board, London, England, on the tests of Heat Transmission thru walls, published in "BUILDINGS" November 1923, shows that the conductivity of a porous construction is far in excess of one that is not easily water permeable.

In addition to its destructive effects upon cement itself, water absorbed by a stucco surface will attack and cause the rusting of metal lath, or the swelling and dry rot of wood lath. This is greatly hastened by alternate saturation and drying out of the stucco, and the deterioration of the lath to which the stucco is applied, naturally hastens the disintegration of the stucco itself, in this connection see Engineering News Record, June 4th, 1925, page 60.

Some crazing, and even cracking of stucco is undoubtedly caused by wind stresses, due to the impracticability of designing an absolutely rigid construction.

Cracking is also frequently caused by the contraction of cement when setting, due to the physical impossibility of getting an absolutely equal distribution of cement thruout the mass.

Other cracks are caused by the drying out and consequent shrinkage, and occasionally, settlement of the construction to which the stucco is applied.

Settlement and shrinkage cracks can be greatly minimized by deferring the application of the final trowelled coat of stucco for 10 or 14 days after the scratch coat, the surface of the latter being well wet down at intervals of 2 or 3 days during this period. This gives ample time for the formation of most of the settlement and contraction cracks that are likely to develop. At the end of that time, all cracks should be raked out and cleaned, and filled at the same time as the final trowelled coat of stucco is applied. Most of the constructional settlement, and the contraction cracks for the greater thickness of the stucco having already developed, the likelihood of the occurrence of others in the comparatively thin final trowelled coat is considerably minimized.

It is therefore evident that to insure the durability and appearance of Portland Cement Stucco, something must be added to it to replace a deficiency that is inherent to the cement, and that is a material that will render the completed stucco surface, water impermeable.

The addition of hydrated lime to the mixture merely serves to make it "fatty," and more easily workable. It is true that, thru this quality of producing a fatty mixture, by lubricating the water and thereby enabling the particles of cement and sand to pack closer together, hydrated lime produces a somewhat denser and therefore, less easily water permeable mass, but hydrated lime remains lime and is always water soluble under pressure. In addition, the adding of hydrated lime to a cement mixture decreases the compressive strength of the cement in just about direct ratio to the proportion in which it is used, see Bulletin No. 8, Structural Materials Research Laboratory, Lewis Institute, Chicago, Illinois.

The best method of rendering a stucco impervious to water, is to incorporate an integral waterproofing into the mixture of cement and sand. By a waterproofing, is meant a material that will combine chemically with the cement to render the pores of the mass water impenetrable.

The best form for such a waterproofing is a water soluble, or water miscible paste that can be mixed with the gauging water. By this method an absolutely equitable distribution of the Waterproofing thruout the mass is assured, as each drop of water carries with it its proper proportion of the Waterproofing medium.

The composition of such a waterproofing must be such that it is easily water soluble or miscible to ensure proper admixture with the gauging water, and it must be able to combine chemically with the lime released by the cement when setting under the crystallizing action of the water to produce a water repellant compound that will form a lining in the pores, thru which the excess water evaporates, sufficiently powerful to prevent the ingress of water later.

The waterproofing should really be used integrally in all the coats of stucco, but as it renders the surface of each coat water impermeable after the cement has set, it would mean that each successive coat would have to follow at intervals of a few hours, as otherwise proper capillary and monolithic bonds would not be obtained for each coat.

Hydrated lime may, therefore, be used for the brown and scratch coats, and the final trowel coat waterproofed with the integral waterproofing paste, can then be applied after the lapse of the 10 to 14 days interval, before recommended.

A common point of ingress for water into stucco construction is thru the joint between the stucco and the window frames. Even when the stucco is laid tight up against the frames, the shrinkage of the frames when drying and of the cement when setting, will cause these joints to open. They can be kept permanently filled by applying to the edges of the frames, for the full width of the stucco, a coating of **GF** 250 colored elastic cement that will adhere permanently to the frames and to the wet stucco.

A mixture by volume of one part of Portland Cement to two and one-half parts of clean sharp sand, will produce a better and more durable stucco than a richer mixture. A richer mixture will be more likely to check and craze, due to the greater proportion of cement, and the consequent uneven contraction of the surface when setting.

The only way to prevent further deterioration of stucco already in place is to apply to the exposed surfaces a transparent waterproof coating that will fill the pores and prevent the entrance of water, without materially changing the texture or general appearance of the stucco.

Such a coating being a liquid, cannot fill or bridge over any cracks in the stucco. All cracks should first of all be scraped out and filled with **GF** 250 colored elastic cement. If the cracks are not filled, the water upon the waterproof surface of the stucco being unable to soak in, will run down and a greater proportion of it will find its way into such cracks than if the surface of the stucco were not waterproofed.

A transparent waterproofing will not hide any stains or discolorations of the surface. If it is desired to attain this result as well as to waterproof, a specially made cement paint should be used, instead of the Transparent Waterproofing. This will give the stucco a smooth, waterproof, flat or gloss finish of any desired color.

In this case it is also necessary to first rake out and point up all cracks with a colored elastic cement.

When either a transparent or a paint waterproof coating is used, the joints between window frames and stucco should be caulked to within a quarter of an inch of the face with oakum or mineral wool, and then filled in on top flush with the face of the stucco with colored elastic cement, the same as that used for filling the cracks.

The cost of integrally waterproofing the final trowelled coat of stucco by means of an integral waterproofing paste in the gauging water, is only that of the Waterproofing itself, as, being simply dissolved in the gauging water, there is no additional labor cost involved. The cost of this waterproofing averages about 2c per square yard of stucco.

The cost of two coats of transparent waterproofing or of a cement paint, to the faces of completed stucco walls, is about 2½ to 3½c per square foot of surface.

The cost of a colored elastic cement fill for the joints between stucco and window frames, is about 45c per window.

An additional outlay therefore, of about 5% of the cost of the stucco, will ensure the obtaining of a stucco surface that will be waterproof and stainproof, thereby securing the durability and permanent beauty of this desirable and exceptionally adaptable low cost form of construction.

Best results are secured by waterproofing the final coat of stucco with **GF** Integral Waterproofing Paste (**GF** 10) or **GF** Integral Powder (**GF** 11). By final coat is meant the last coat which is uniformly applied with the trowel, and does not include spatter dash or other similar finish coats.

To obtain the best results on stucco work and minimize checking and hair cracks the final coat should not be put on until after a lapse of at least 10 days, during which time the surface should be frequently wet down (daily if possible). Before applying the final coat, all checks and cracks should be cut out and filled.

GF 10 is mixed with the gauging water (1 to 17), **GF** 11, with the cement 2 lbs. to each bag. It therefore requires 3 lbs. of **GF** 10 or 4 lbs. of **GF** 11 to waterproof 100 sq. ft. of final coat.

Hair checking and cracking of Portland cement stucco is attributable to several causes, such as application to wood lath, insufficient bracing of frame construction or spacing of joists, wind stresses, use of too much water, or trowelling too soon.

When stucco is applied to wood lath, the wood absorbs considerable water. This not only robs the stucco of this water, but it causes the lath to swell. Afterward the water dries out, the lath shrinks, and the pull of the lath shrinking is sufficient to cause the stucco to crack. If the stucco is not waterproof, the absorption of water and swelling of the lath occurs with every rainstorm.

The use of GF 10 Paste will prevent absorption of rain water, and obviate that cause of cracking. The use of metal lath will obviate another cause.

A very good way to minimize the danger of surface checking from settlement, or drying out of the construction, is to put on the scratch coat and then let it stay for about three weeks, wetting it down well every day. This gives a good period of time for the development of expansion, contraction and settlement cracks.

Then rake out all such cracks, fill them with Portland Cement plaster, and follow immediately with the final coat of Portland cement stucco, so that the filling of cracks, sets and bonds with the final coat.

A sure way of bonding the final coat to the scratch coat, is to use GF 400 Bonding Compound.

The method to use for either magnesite or Portland cement stucco that is leaky, is to point up all cracks and open joints with GF 250 Grey, or Colored, Elastic Cement, and then apply two coats of GF 100 Transparent Waterproofing as detailed on pages 52 and 53 of the Handbook.

Two coats of GF 100 are almost always sufficient for Portland cement stucco, but, as the object of a surface application is to render the pores of the surface water repellant, it often happens that, due to its greater porosity, it requires as much as three or four applications for magnesite stucco. GF 160 is also sometimes used for this purpose with magnesite stucco, but even that requires two or three coats.

SPECIFICATIONS

For Dampproofing Stucco to be applied to Trussit, Self-Sentering, Herringbone Metal Lath, Wood Lath, Brick or Tile

Paragraphs 1, 2 and 3 to be followed carefully, and

47—Mixing

The mortar for the scratch coat shall consist of one part Portland Cement to two and one-half parts clean, sharp sand and 1½ pounds of hair to each bag of Portland Cement. If Hydrated Lime is used, it shall be not in excess of one-third of the volume of cement.

For back-plaster coat the mortar shall consist of one part Portland Cement to two and one-half parts of clean, sharp sand and GF Integral Waterproofing Paste (GF 10) or GF Integral, Powder (GF 11).

The final coat shall consist of one part cement, two and a half parts of clean, sharp sand, and GF 10 shall be added to the tempering water in the proportion of one gallon of GF 10 to each 17 gallons of water, or two pounds of GF 11 Powder to each bag of cement.

48—Application

The plastering shall be carried on continuously in one general direction, without allowing the plaster to dry at the edge. If it is impossible to work the full width of the wall at one time, the joint should be at some natural division of the surface, such as a window or door.

The first coat shall be applied to the outside of the lath and pressed through sufficiently to give a good key. Over the face of the studs the plaster shall be forced well through the lath in order to fill entirely the space between the lath and the stud. The backing coat shall be applied to the back of the lath and shall be thoroughly trowelled so that the lath shall be entirely covered. The final coat shall be applied to the face of the first coat.

49—Roughening

Soon after applying and before the initial set has taken place, the surface of the first coat shall be scratched with a saw-tooth paddle or other suitable device to provide a good bond for the final coat.

50—Dampening

Before applying mortar the surface of the preceding coat shall be thoroughly saturated to prevent absorption of water from the fresh mortar.

51—Thickness of Coats

The first coat shall be at least ⅜″ thick over the face of the lath and project through behind the lath about ⅜″. The backing coat shall increase the thickness behind the lath to not less than ⅝″. The final coat shall be not less than ⅜″ thick.

52—Drying Out

The final coat shall not be permitted to dry out rapidly and adequate precaution shall be taken, either by sprinkling frequently after the mortar has set hard enough to permit it or by hanging wet burlap over the surface to keep the surface of the stucco damp.

53—Freezing

Stucco shall not be applied when there is likelihood of freezing, unless GF 12 Cement Accelerator and Frost Preventive is also used. In this case the waterproofing shall consist of 2 lbs. of GF 11 Waterproofing Powder mixed dry with each bag of cement.

To form a watertight joint for stucco around door or window frames, apply to the edges of the frames a good coat of either GF 250 Colored or GF 251, and then place the stucco immediately against it. The elasticity of the GF 250 or GF 251 will keep this joint filled when the stucco, drying out, shrinks from the frames.

WATERPROOFING MAGNESITE COMPOSITIONS

It is practically impossible to produce a mixture of magnesite and chloride that will be waterproof in itself or to achieve that result by the addition of any other product to the mixture.

Limited waterproofing, or rather dampproofing results have been obtained by using GF 10 Waterproofing Paste integrally in the mix, but that can only be used in such a small proportion that the results are more in the nature of retarding the set of the magnesite affording more time to give a better trowelling, and thereby densifying the mass, which makes it *less* water permeable, than in making it integrally waterproof.

When used for this purpose, one gallon (8 lbs.) of GF 10 is dissolved in four gallons of water, and then one quart of this solution is put into the chloride (12 to 15 gallons) that is used for wetting up three bags of dry composition. This amounts to using about two and one-half ounces of GF 10 to one bag of magnesite, and as the proportion for waterproofing cement is about twenty-two ounces per bag of cement, it is obvious that such a small quantity can have little real integral waterproofing value for practically the same volume of material.

GF 10 is a stearatic paste, and must first be brought into solution in water, for if put directly into the chloride, or if the solution of GF 10 and water is used in greater proportion than stated above, the oxy-chlorides will cause the GF 10 to "jell."

The cementitious properties of all magnesite compounds lie in the magnesium oxy-chlorides, which are formed by the chemical reaction of the magnesium chloride upon the calcined magnesium oxide.

The strength of the magnesium chloride solution usually 22° Beaume, will vary with temperature and atmospheric humidity and is not absolutely determined by the hydrometer, which is a measure of specific gravity, and only determines the amount of magnesium chloride dissolved in the water.

Magnesium oxy-chloride is always water soluble, and in the presence of water breaks down into its constituent parts, thereby lessening its cementitious value. Submerge a piece of magnesite stucco in water for twenty-four hours and at the end of that time, you will find that a considerable quantity of magnesia salts have been dissolved out of it into the water, thereby reducing the essential binding elements of the stucco. This can also be proved by the bitter magnesium chloride taste of a little water placed for a few minutes on a piece of magnesite stucco.

As in the case of Portland cement, the presence of any salts in the finished product will exert an expansive and consequent disintegrating effect upon any product of a cementitious nature.

It is not possible to introduce a sufficient quantity of any other product into magnesium chloride and magnesium oxide to make the mixture water insoluble. The addition of any other material of a different chemical nature, will prevent the complete reaction between the two necessary for the formation of the oxy-chlorides, which are the basis of the cementitious value of the mixture.

Practically all the deposits of magnesite in this country, vary considerably in the analysis of the various veins in even the same deposits, and few of them run less than 1% in lime content.

In calcining magnesite containing calcium carbonate, the latter becomes an oxide. During the process of combining the magnesium chloride with the magnesium oxide, the calcium oxide contained in the latter may make a weak union with the magnesium chloride, forming magnesium-calcium-oxy-chloride, but the combination is unstable and the tendency is for the calcium oxide and the magnesium chloride to separate and repel each other.

Calcium oxide is always thirsty, and will hydrate from moisture in the air or from rain, turning into calcium hydrate. In so doing it expands and exerts strains and stresses that cause cracks and disruption of the mass. This is above and beyond the expansive and destructive action of water upon any mixture of a cementitious nature.

It is also very difficult to obtain pure magnesium chloride, which is usually made from evaporation of sea water, or similar saline waters. All these waters also contain sodium chloride, sodium sulphate, potassium chloride and other soluble salts, all of which exert a destructive effect upon the finished products.

As the solubility of the various salts, etc., above mentioned vary according to temperature and atmospheric changes, it is easy to understand that the space of time in which their destructive effects will become apparent in the finished work, will vary accordingly in different localities. This may take several years in some cases, but the deleterious elements in all cases are present and eventually will make their presence known.

To sum up, it seems that under prevailing manufacturing conditions it is impossible to use the present magnesite deposits to obtain a magnesium oxide free from dolomite lime, or to manufacture magnesium chloride free from the other salts before mentioned, which are the fundamental causes of disintegration of magnesite compositions.

Until 100% pure magnesite deposits are found, or until an economical chemical or physical method is discovered for isolating the magnesia and the chloride such compositions must remain in their present unstable and uncertain condition.

Magnesite stucco or flooring after it has set and dry, can to a very great extent, be rendered waterproof by coating with a transparent waterproofing, such as GF 100 or GF 160, which will fill the pores of the surface and prevent water from coming in direct contact with the composition.

The inherent defects of the magnesium oxide and magnesium chloride above mentioned, can be greatly aggravated by entrusting to unskilled help, the proportioning of the dry composition, the mixing and adding of the necessary quantity of chloride solution. In making the admixture, conditions of temperature, humidity, hydroscopic nature and content of various sands or of the same sand at different times, must all be taken into consideration at the exact time of doing the work. Trowelling the surface so as to get it as hard and dense as possible also has an important bearing on the finished work.

WATERPROOFING CEMENT BLOCKS, BRICKS, VAULTS AND ARTIFICIAL STONE

The manufacturers of cement Blocks, Bricks, Vaults, Artificial Stone and similar products, have their own formulas for mixes for their products. These products are usually made under compression, with a very small quantity of water, sometimes as little as 1½ gallons to a bag of cement.

In such cases, the quantity of water that is going to be used per bag of cement, must be determined, and GF 10 added to this water in such proportions that 1½ lbs. of GF 10 will be used for each bag of cement.

Crazing of cement surfaces is very prevalent all over the country, and there are many causes which lead to this. Excluding the saturation with water and subsequent freezing the other main reasons are:—

1. The use of too much water in the mix, that is, using more than three gallons per bag of cement. Water in a cement mixture fulfills two purposes. First it acts chemically upon the cement causing it to crystallize, and secondly it lubricates the mixture and enables the particles of cement and aggregate to pack in together. More water is required for lubricating than for chemically acting upon the cement, and this surplus water has to evaporate thru the sides or exposed surfaces. When this surplus water rises to the surface, it brings with it the fine flour of the cement, and when the water evaporates into the air, the fine flour remains on the surface where it sets very quickly, forming a thin film of almost pure cement. This has a different coefficient of expansion and contraction than the mixture below, with the result that it dries out and forms very fine hair cracks. The use of more than three gallons of water per bag of cement, will cause the bringing to the surface of a great deal more of the fine flour of the cement, and consequently increase the checking or crazing of the surface. This is evidenced by the checking and cracking that occurs on the surfaces of small pats made of pure cement and water.

2. The use of too rich a mixture, that is to say, richer than 1 to 2, or what is preferable 1 to 2½, if the sand is clean, sharp and well graded.

3. The use of too much fine sand or stone dust in the mixture. No stone dust or sand should go into a stone mixture that will pass a No. 20 screen.

Either of the above causes No. 2 or No. 3, will result in an unequal distribution of the cement thruout the mix, especially on the surface, which means that there will be patches of practically pure cement on the surface, and this will have the same effect as using too much water, as noted in No. 1 above.

4. Trowelling off the surface while it is too soft, which will bring up the fine flour of the cement as noted in No. 1 above.

5. Trowelling off and finishing when it is too dry, and using water sprinkled on top to get a smooth finish.

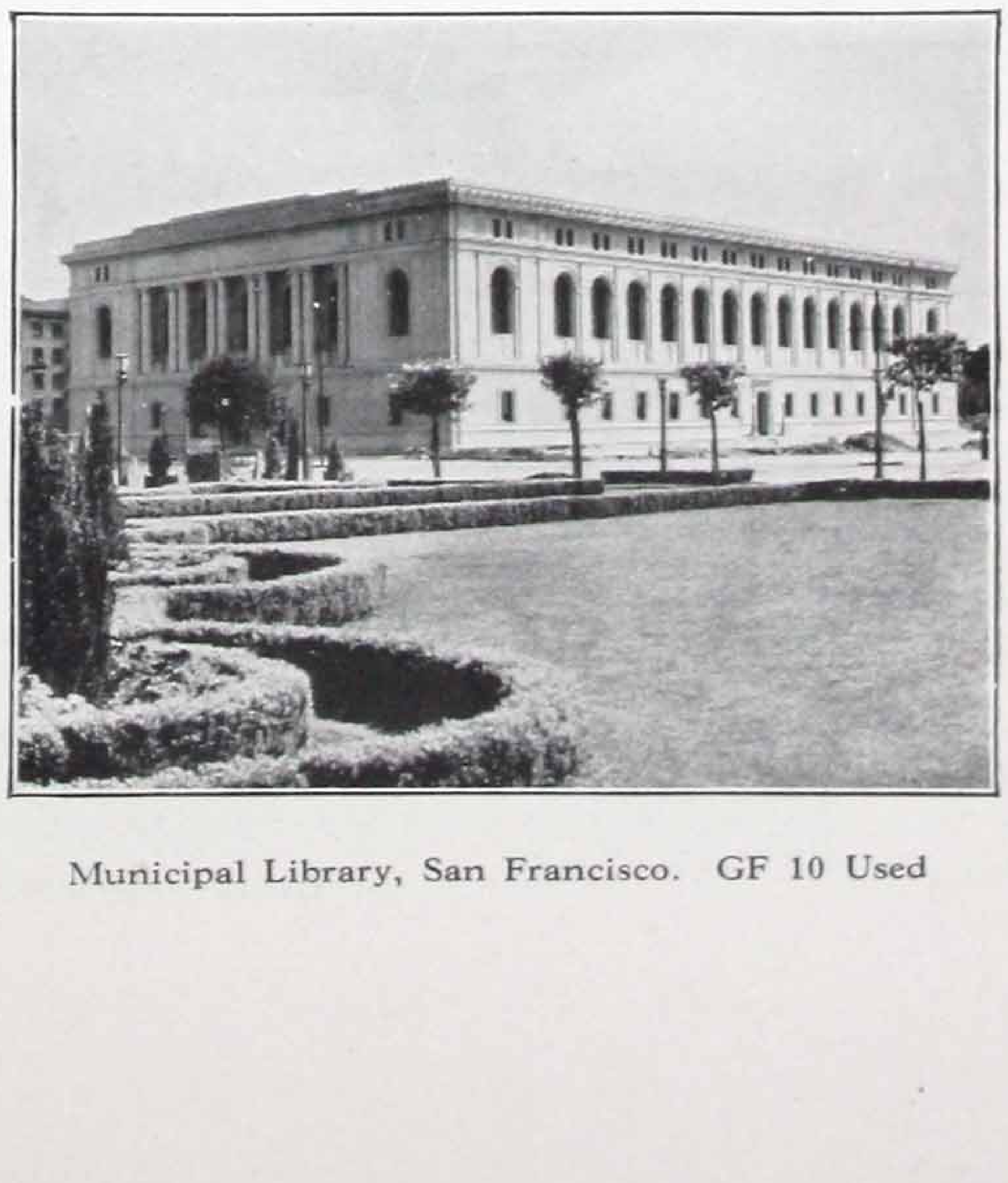
6. Dusting dry cement over the surface to enable the trowelling to be done quickly by taking up surplus water. This will have the same result as No. 1 above.

7. Passage of wind or dry warm air over the surface or allowing it to dry out too quickly, which will cause the cement on the surface to set before that in the mixture below.

8. Failure to keep the surface wetted down for two or three days, which means the water will be drawn off into the air too quickly before it has had time to exert its proper crystallizing action upon the cement of the surface.

In the case of artificial stone and similar cement work, crazing can be entirely prevented by surface treatment and by the use of granite or trap rock chips in the mixture, and especially avoiding the use of stone dust or finer sand than will pass a No. 20 screen. By surface treatment is meant, the entire removal of the cement film of the surface. This can be done by waiting until the work has hardened sufficiently, and then grinding exposed surface with carborundum wheels, which exposes the aggregate. Another method of surface treating such work is to spray the surface, while it is still green, with a very fine spray of water under good pressure, just as soon as it is taken from the mould. This washes off the surface cement, and drives some of it back into the concrete exposing the natural surface of the aggregate. The product is then allowed to cure at a temperature of 60 to 70 degrees Fahrenheit, where it is not exposed to passage of dry or warm air over it. Sometimes the surfaces are further treated by scrubbing them with muriatic acid and water which takes away even more of the cement film off the surface and brightens the whole appearance generally.

A careful following of these main points will in no way increase the expense of the work and will assure surfaces practically free from checking or crazing. In addition, the whole work should be waterproofed to prevent saturation with water.



Municipal Library, San Francisco. GF 10 Used

GF INTEGRAL WATERPROOFING POWDER (GF 11)

I *Waterproofing with Integral Waterproofing Powder*
  1. *Integrally*
  2. *Plaster Coat*

II *Waterproofing Cement Mortar Joints*
  1. *Integrally*

III *Waterproofing and Hardening Cast Stone, Cement Blocks, etc.*
  1. *Integrally*

Some architects, in specifying integral waterproofing, require a powder to be mixed with the cement in place of a paste dissolved in the gauging water. In some cases, as for artificial stone and cement work where the least possible quantity of water is used, or in localities where the water contains lime carbonate and alkalies which will precipitate GF 10 before it comes in contact with the cement, it is preferable to use a waterproofing medium in the form of a powder to be mixed dry with the cement. For such work, the powder must be a waterproofed material in itself, and its success largely is dependent upon very careful and thorough mixing with the cement.

DESCRIPTION

GF Integral Waterproofing Powder (GF 11) is the same material which forms when GF Paste (GF 10) combines with cement. It is therefore classed as a preformed waterproofing element.

In the finished mass, whether concrete or mortar, GF 11 retains its water repellent qualities permanently. In no way does it affect the set of the material with which it is used.

Method of Using GF 11

GF Integral Waterproofing Powder (GF 11) is to be added to Portland Cement in the proportion of two pounds to each bag of cement or eight pounds to each barrel of cement used in any mixture. The GF 11 and cement are to be thoroughly mixed dry so as to insure complete distribution of the waterproofing powder.

Add this mixture to the sand, which never should be less than two parts nor more than two and a half parts by volume to one part of cement, the whole to be worked until the mass is evenly mixed and is uniform in color. In case of mass concrete, this mixture is to be added to the aggregate and thoroughly mixed with it.

Shipping Data

Shipped five 50 pound bags in barrel.

For quantities required see tables on page 77.

SPECIFICATIONS

For waterproofing by means of GF Integral Waterproofing Powder (GF 11)

The specifications for the use of GF 11 are in all cases exactly the same as described for GF 10 for either mass concrete or the plaster coat method, except that GF 11 Waterproofing Powder is used instead of GF 10 Waterproofing Paste.

GF 11 Waterproofed this Reservoir of St. Joseph, Mo.

GF CEMENT ACCELERATOR (GF 12)

I Frostproofing
II Accelerating Set
III Hardening Cement Work
IV Dampproofing Concrete, Cement Mortar and Mortar Joints
V Miscellaneous Uses
  Cement Floors
  Cast Stone,
  Road Repairs,
  Cement Wash, etc.

DESCRIPTION

GF 12 has so many advantageous features that the name "Cement Accelerator" is not thoroughly descriptive. GF 12 is a cement accelerator, but it is also a cement hardener, frost preventive and waterproofing agent. When it is used primarily for any one of these four purposes, the contractor benefits by the remaining three results achieved.

This product is unique in that its first cost is saved several times over, and contractors find it economical to use even though it is not specified.

GF 12 is a colorless liquid made on a 30 degree Beaume solution of calcium chloride base, which is the strongest possible to be kept in solution. The corrosive elements which are present in ordinary calcium chloride have been neutralized by a partial formation of the oxy-chlorides which, on reaction with the Portland cement, form true oxy-chlorides that are far more stable than the magnesium chloride and magnesite oxy-chlorides.

There are many arguments and proofs in favor of the use of GF 12 Accelerator for all concrete and cement work contained in the Report of the Proceedings of the 20th Convention of the American Concrete Institute 1924.

The report of J. C. Pearson and Frank A. Hitchcock, of the U. S. Bureau of Standards, on the "Economic Value of Admixtures," page 312, gives full detailed results of the extensive series of tests they conducted with Cement Accelerators of a Calcium Chloride base.

They found that plain commercial Calcium Chloride is not as effective as Calcium Chloride Compounds like GF 12.

The following is a summary of their tests:—

1. Accelerators increase the density of the mass.
2. Accelerators increase the yield of all mixtures.
3. Accelerators increase the workability of all mixtures.
4. Accelerators decrease the loss of water by evaporation from the mass.
5. Accelerators decrease the quantity of water necessary for mixing.
6. Accelerators increase the compressive strength of the work.

1. Densifying the mass tends to make the finished work more waterproof.

2. Increasing the yield (which means more concrete per bag of cement) tends to lower the cost of a cubic yard of concrete.

3. Increasing the workability tends to make the concrete flow and work into position more easily.

4. Decreasing the loss of water by evaporation means that the work does not dry out too quickly so that the water is retained until it completes its very necessary work of crystallizing the cement.

5. Decreasing the quantity of water necessary to obtain a workable mix is a very important function continually in demand by Professor Duff Abrams and other concrete engineers.

6. Increasing the compressive strength of the work needs no further comments.

These constitute six convincingly powerful arguments for the use of GF 12 Cement Accelerator in all kinds of concrete and cement work, at all seasons of the year, irrespective of its especial qualities as a frost preventive in winter work.

There is a seventh even more convincing argument, from the contractor's standpoint, and that is, the increased amount of work (floor topping or plaster coat) that GF 12 practically compels a cement mason to produce in a given time. This is due to the acceleration of the setting time of the cement which eliminates the two or three hours usually lost waiting for the cement to take its initial set.

An eighth argument in favor of GF 12 is the fact that floor topping can be put on at time arch is poured, so that the whole gang works a full day and work proceeds continuously, without delay or interruption, with only two or three hours overtime for the finishers. The consequent saving of time, labor, protection and numerous other features will be at once apparent to any reinforced concrete or cement man.

Water content is a vital item in connection with all our products introduced into the mixture by means of the water.

The quantity of water used for floors, stucco or plaster coat of mortar is generally about 2¾ to 3 gallons per one bag batch for 1:2 or 1:2½. More water would make the mixture too sloppy to apply, and less water would make it too stiff. In the case of concrete the range is considerable. Some contractors use 6 and some 9 gallons per one bag batch 1:2:4 or 1:2½:5. Workable concrete cannot be made expeditiously with less than 6 gallons per one bag batch, as less makes the mixture too dry to be easily compacted. The Robt. W. Hunt Company Laboratories, desiring to use a minimum of water, used about 6¼ gallons per one bag batch 1:2:4. Most contractors have very hazy ideas as to the quantity of water to use per yard of concrete. We therefore have to form our specifications to ensure the use of at least sufficient GF product in the water to get the correct amount per bag, barrel or yard. In all our literature we have based our calculations on a minimum of 6 gallons of water per one bag batch for concrete and 3 gallons per one bag batch for cement work.

The Portland Cement Association recommends the use of calcium chloride, as an accelerator and frost preventive, in the proportions of 3% to 6% of the weight of water used. The report of the Director of the Bureau of Standards, page 144, states that the compressive strength of concrete containing calcium chloride up to 10% of the weight of water is 30% to 100% greater than plain concrete, the best results being obtained with 4% to 6%. Tests also showed that, at the end of one year, the calcium chloride in no way affected the durability of the concrete, but it did corrode the reinforcing bars.

In GF 12, all corrosive elements which are present in ordinary calcium chloride have been neutralized. GF 12 will not corrode steel and can be used without fear in direct contact with reinforcing bars.

Tests of GF 12

The following is a copy of the Report of Tests made by the Kansas City Testing Laboratories showing the comparisons between initial and final setting times, and also the compressive strength at various ages on cement work made with and without **GF 12**.

This report shows that by the use of **GF 12** the initial setting time of cement can be reduced 46% to 89%, and the final setting time 58% to 76% according to the quantity of **GF 12** used.

The report also shows that **GF 12** increases the compressive strength at all ages from 264% to 577% at 8 hours old, to from 22% to 47% when 28 days old.

Ignoring the value of **GF 12** in increasing the compressive strength of the work, its great value lies in the reduction of the setting time of the cement as that is the time at which the danger period of damage by frost is passed.

The report shows that, according to the quantities of **GF 12** used, the cement is set beyond danger of damage by frost in from 95 minutes to 165 minutes after it is wet up as against 390 minutes required for plain cement. During this period of time the work is prevented from freezing by the internal warmth generated and maintained in the mass by the chemical combination between the **GF 12** and the cement.

For this reason the use of **GF 12** integrally in the mix is far more effective than merely sprinkling the surface of the work with a solution of the crystals. The latter method merely serves to harden the surface and partially close the pores, without imparting any actual additional strength to the work itself, while **GF 12** does this, and in addition, affords absolute protection against frost, at the same time increasing the strength of the work at all ages, especially at those critical periods when the work is from 4 hours to 15 hours old.

It is to be noted that the increase in compressive strength is about proportional to the increase in the quantity of **GF 12** used.

KANSAS CITY TESTING LABORATORIES, NOV. 4, 1924
COMPARISON OF SETTING TIME

Proportions of GF 12 to water	Initial Setting Time		Final Setting Time	
	Plain Cement	With GF 12	Plain Cement	With GF 12
1-10	2 hrs.	1 hr. 5 min.	6 hrs. 30 min.	2 hrs. 45 min.
2-10	2 hrs.	18 min.	6 hrs.	1 hr. 50 min.
3-10	2 hrs.	13 min.	6 hrs.	1 hr. 35 min.

COMPARISON OF AVERAGE COMPRESSIVE STRENGTH PER SQUARE INCH

Proportions of GF 12 to water	Age After Final Set	Plain Cement	With GF 12
1-10	4 hours	none	660 lbs.
2-10	4 hours	none	956 lbs.
3-10	4 hours	none	1192 lbs.
1-10	8 hours	188 lbs.	684 lbs.
2-10	8 hours	188 lbs.	997 lbs.
3-10	8 hours	188 lbs.	1272 lbs.
1-10	15 hours	188 lbs.	1376 lbs.
2-10	15 hours	188 lbs.	1854 lbs.
3-10	15 hours	188 lbs.	1928 lbs.
1-10	48 hours	2751 lbs.	3913 lbs.
2-10	48 hours	2751 lbs.	4780 lbs.
3-10	48 hours	2751 lbs.	4956 lbs.
1-10	7 days	3981 lbs.	6224 lbs.
2-10	7 days	3981 lbs.	6884 lbs.
3-10	7 days	3981 lbs.	7093 lbs.
1-10	28 days	6669 lbs.	8106 lbs.
2-10	28 days	6669 lbs.	9228 lbs.
3-10	28 days	6669 lbs.	9722 lbs.

Proportions 1-10, 2-10, 3-10 **GF 12** to Water, means mixing 1, 2 or 3 gallons of **GF 12** to each 10 gallons of water used for wetting up the mixture.

The results of these tests, as regards setting times, are more favorable to plain cement than those given by Professor Duff Abrams in his Specifications and Tests for Portland Cement, referred to in the "ENGINEERING WORLD" February 1925, page 97, which gives the final setting time for Portland Cement as not more than 10 hours.

NOTE: GF 12 is a saturated solution which means that the water contains as much of the chemicals as it can hold in solution. Exposure to low temperature reduces the saturative capacity of water, the excess chemical in the GF 12 crystalizes and in so doing crystalizes the whole mass. When this happens it is easily brought back into solution by putting a steam hose into the crystals for a few minutes or by pouring in 1 gal. of boiling water for every 10 gallons of GF 12.

Other favorable reports on the use of GF 12 are contained in:—

Proceedings American Concrete Institute 1924.
Report on "Economic Value of Admixtures" by J. C. Pearson & W. A. Hitchcock of the U. S. Bureau of Standards.
"Reinforced Concrete and Masonry Structures" by Hool and Kinne, pages 44 and 145.
"Use of Chemicals to Accelerate the Hardening of Concrete," by the Portland Cement Association.
Engineer and Mining Journal Press, February 9th, 1924, page 239.
Engineering News Record, April 3rd, 1924, page 577.
Buildings,—July 25th, 1923, page 202.
Annual Report, Director of Bureau of Standards 1918, page 144.

From the foregoing it is evident that GF 12 is a valuable product to use in all cement work at all seasons of the year for other reasons than its frost preventive qualities and its use among contractors in all classes of such work is rapidly increasing.

Shipping Data
Shipped in

1-gal. cans	30-gal. half drums
5-gal. cans	55-gal. drums

Shipping weight
12 lbs. per gallon. Net. 10½ lbs. per gallon.

GF 12 AS A FROST PREVENTIVE

GF 12 acts upon the cement, upon the water and upon the entire mixture. First, it accelerates the set of the cement, so that the work is exposed for a minimum of time to the danger of frost. Second, it lowers the freezing point of the gauging water and, third, it generates heat so that the temperature of the whole mixture is held above freezing point until the cement is set sufficiently to preclude damage by cold. This demands more work of the GF 12 so it requires more per bag of cement, per gallon of water or per cubic yard of concrete.

There must be enough GF 12 in the mixture to offset the radiation of heat from the mass, which is governed by the temperature adjacent to the work. Roughly speaking each quart of GF 12 used per bag of cement will raise and maintain the temperature of the mass 5° or 6° Fah. until the concrete is set.

Cement stucco put on in early spring or late fall when frosts occur at night is liable to become injured. GF 12 will obviate this by causing the stucco to set up by the time its exposure to frost occurs.

The mortar used in laying up brick in winter weather should always be treated with it. In these cases the mortar is spread so thin that it is impossible to prevent freezing by using heated aggregates as they cannot be prevented from cooling quickly.

NOTE: When GF 12 is used as an anti-freeze mixture with cement mortar, it still retains its property of acceleration. The size of the batches should be fixed with this condition in mind.

The proper amount of GF 12 to use must be left to the discretion of the building superintendent who must anticipate the lowest temperature to be expected for two hours after the work is placed and plan accordingly.

SPECIFICATIONS

For using GF 12 as a Frost Preventive

General: Materials, Mixture, Method of Mixing, Pouring and Troweling will follow Standard Practice

For Concrete

If using 34 to 36 gallons of water per yard of concrete, GF 12 should be mixed with water in the following proportions:—

Actual or expected Temperature	Mixture
29°	1 to 20 which equals 1¾ gals. per yd. of concrete or 1 qt. per bag of cement.
24°	2 to 20 which equals 3 gals. per yd. of concrete or 2 qts. per bag of cement.
17°	3 to 20 which equals 3¾ gals. per yd. of concrete or 2¼ qts. per bag of cement.

For Cement Mortar, Stucco and Topping

If not more than 3 gallons of water are used for wetting up the mixture containing one bag of cement, GF 12 should be mixed with water in the following proportion:—

Actual or expected Temperature	Mixture
29°	1 to 10 which equals 3¾ gals. per yd. of mortar or 1 qt. per bag of cement.
24°	2 to 10 which equals 7½ gals. per yd. of mortar or 2 qts. per bag of cement.
17°	3 to 10 which equals 11¼ gals. per yd. of mortar or 3 qts. per bag of cement.

NOTE: The difference shown above between the quantities of GF 12, as a frost preventive, in concrete and cement work, is easily explainable. In a yard of concrete there are 1½ or 1¼ barrels of cement and about 36 gallons of liquid; in a yard of cement mortar there are 3¾ barrels of cement and about 41 gallons of liquid. The GF 12 acts mainly upon the water when used for frost prevention therefore it requires less per barrel of cement in the mixture. The additional quantity per yard of mortar is required for the additional quantity of cement used.

Water Direct to Mixer

When using a mixer with direct water supply, a solution of GF 12 and water in the proportions of 1 gallon of GF 12 to 1½ gallons of water can be made in a barrel adjacent to the mixer. Put this solution into the mixer in the following proportions for different temperatures and immediately let in enough water to bring the batch to the proper consistency.

Actual or Expected Temp.	Quantity of Solution
29°	½ gal. for each bag of cement
24°	1 gal. for each bag of cement
17°	1½ gal. for each bag of cement

This method applies to either concrete, cement mortar, stucco or topping.

GF 12 AS AN ACCELERATOR

In reinforced concrete construction a monolithic bond between the floor finish and the concrete is essential. As every practical construction man knows, it is several months before ordinary concrete attains its final hardness, and using a cement floor before it is hard enough to withstand traffic invariably results in injury. Consequently the floor topping is either put on at time of pouring the concrete, necessitating considerable overtime work and expensive precautions for protecting the finish afterwards, or the top finish is put on after the construction work is finished.

In the latter case the concrete surface becomes dirty, worn and pitted, so special precautions must be taken to secure a monolithic bond for the finish to the concrete, and, in addition, it usually takes 1¼″ to 1½″ of finish over all, instead of 1″, to finish up to the established floor levels. Either method is expensive and more or less uncertain.

A floor in which **GF 12** is used will not develop trouble. It attains a month's age in three days and, being protected against the effects of use, the topping can be put on at time of pouring without excessive overtime, as the top finish will set so that it can be trowelled almost immediately. A monolithic bond is thus assured and construction can proceed uninterruptedly without special protection for the finished floor surface.

GF 12 acts upon the cement, causing it to set quickly, thus permitting the forms to be removed sooner. For accelerating set, one quart **GF 12** per bag of cement is sufficient. The top finish is put on immediately after the rough slab is poured and is ready for trowelling and finishing almost as soon as it is applied. The floor may be walked on the next day.

Monolithic floors thus are achieved more cheaply than through any other method. One man can finish about 50% more area per day, or the gang can work a full day, with only two or three hours overtime for the finishers, and as before mentioned, the floors are ready for use the next day.

GF 12 will cost the contractor about one half cent per square foot of surface. Against this, if it were not used, would be a cost of at least three cents per square foot for finisher's overtime if the floors are made monolithic. In addition, the floors must be left undisturbed for not less than a week. If only the rough slab is poured, there is the inconvenience of allowing it to set, and the extra cost of preparing floor arches to receive finish, together with extra thickness required to bring floors up to established levels, due to wearing off the concrete arch during construction. Overtime for finishers, cost of obtaining bond and additional thickness of finish will amount to between two and three cents per square foot. The cost saving features of **GF 12** clearly are apparent.

GF 12 is applicable to any part of a building for any kind of cement construction whether concrete, brick or stucco. It necessitates no extra labor cost and saves its own cost many times over in increased volume of work in all temperatures, winter or summer, whether used in the actual construction itself or in stucco or floor finish.

AS A HARDENER

GF 12 acts upon the cement, making the crystalline action from 50% to 60% more effective, thereby causing the floor to attain its hardness in 3 days instead of 30. For this purpose 1 quart of **GF 12** per bag of cement is sufficient. The hardness of floors is also increased by the accelerating action of the **GF 12**, which necessitates greater effort in trowelling, so that the effect is about the same as that of the old time Architects specifications calling for 2 trowellings.

AS A DAMPPROOFING

Against intermittent water pressure for short periods of time such as for a floor occasionally flooded with water or with water running rapidly over it, **GF 12** acts with the gauging water as a lubricant, much the same as hydrated lime, enabling the aggregates to pack closer together. It also acts upon the cement by forming calcium tri-silicate, which is water insoluble. Thus, it makes a denser and consequently more waterproof mass, and deposits a water insoluble compound in the pores. Because of its lubricating action, less water is needed to make an easily workable mixture. For dampproofing concrete, a mixture of 1-20 should be used, which equals 1 quart **GF 12** to each bag of cement or 1½ gallons per yard of concrete. For cement work, a mixture of 1-10 is required, which equals one quart per bag of cement.

In cases of actual waterpressure, **GF 12** should be supplemented by **GF 11**, dry mixing 2 lbs. of **GF 11** waterproofing powder with each bag of cement. **GF 10** is not suitable, for it is precipitated when in conjunction with **GF 12**.

MISCELLANEOUS USES, GF 12

Sidewalks and Floors—When used for sidewalks and exposed work, **GF 12** causes the cement to set sufficiently within a few hours so that a rainstorm, or frost at night will not damage the work. The cement may be walked on the next day.

Floor Hardening—Instead of waiting weeks for floors to become hard enough for use, **GF 12** so speeds the setting that three days after being laid the cement has acquired the usual month's age and, in addition, has a remarkably hard, smooth, dustless, glossy surface.

Drilling Test Holes—Often when drilling wells or testing for oil, ore, etc., the drill encounters a hard substance which throws the drill rod out of line. To prevent breaking, the drill is withdrawn, the hole filled with cement mortar and when hard, a new hole put through. When GF 12 is used, the cement becomes sufficiently hard in a few hours to hold the drill in line, so that drilling may proceed without further delay.

Fence and Telegraph Poles—When GF 12 is used in the mixture, cement fence posts and telegraph poles are ready for placing three days after being poured, and are already waterproofed.

Artificial Stone, Cement Blocks, Furniture, etc.—GF 12 waterproofs, gives the surface a smooth, rock-hard finish and causes the work to acquire a thirty-day texture in three days. This means that the cement work is ready for storage in the minimum of time and that the risk of damage is lessened.

Road Work and Repairs—Traffic is delayed for the shortest possible time when GF 12 is used, for the concrete underbed is ready to receive the finishing coat in one to two days, and the road can be opened for service three days after the final surfacing is applied. Equipment is freed for other work, labor costs are reduced and the goodwill of the community is obtained.

Cork Insulation—GF 12 speeds the setting of the mortar used for erecting cork insulation in refrigerating plants so that in one day the work is ready to receive the finishing treatment.

As a Cement Wash—An excellent cement grout for washing over concrete surfaces is made by mixing white Portland cement with a one to ten mixture of GF 12 and water. The wash should have the consistency of paint. The GF 12 causes the gauging water to enter into immediate combination with the cement, rather than to evaporate, and the wash adheres firmly to the surface without dusting or brushing off.

SPECIFICATIONS

For GF Cement Accelerator (GF 12) as an Accelerator, Hardener and Waterproofer

The materials, mixture, method of mixing, pouring, and trowelling used will follow standard practice.

GF 12 will be mixed with the gauging water in the proportion of 1 quart to each bag of cement used.

GF 12 COLORED

Because cement floors and cement or lime plastered walls present a cold and cheerless appearance they are often painted, or ordinary mortar colors used in the mix in an endeavor to alleviate the situation.

Mortar color is also used with lime and cement mortar to make the joints of masonry harmonize or contrast with the brick color scheme.

It is often desired to give a tinted finish or face to cement tiles, blocks and artificial stone.

Cement paints wear off and become stained and dirty while ordinary mortar colors fade out.

The most satisfactory method is to incorporate a permanent, uniformly distributed coloring in the cement or mortar mix.

GF 12 Colored is a paste made of GF 12 Cement Accelerator and Frost Preventive with coloring pigments added. These pigments are mineral oxides which are the least affected by the actinic rays of light, and the colors are therefore the most permanent obtainable.

Provided an excess of water is not used, work laid with GF 12 Colored will be ready for trowelling and finishing in about two hours and can, in case of a floor, be safely walked upon after a lapse of two days.

GF 12 COLORED OFFERS THESE ADVANTAGES

1. It can be used with either white or ordinary Portland cement and with lime plaster.
2. It will prevent damage by frost while the work is still fresh.
3. It will accelerate the setting time of cement so that the work is as hard and set throughout its thickness in two days as ordinary work in thirty days, and can be handled or used in that space of time.
4. It will render the surface hard, dustless, wear water and stainproof.
5. Wall or floor finishes in which GF 12 Colored is used can be washed and easily cleaned of all dirt and stains.

A Substitute for Tile

GF 12 Colored is an inexpensive, reliable and permanent substitute for expensive tile work in porches, bathrooms, vestibules, hallways, corridors, showrooms, stores, theatres, hospitals, public buildings, swimming pools, etc., and wherever a hard, waterproof, dustless, wear and stainproof, decorative cement or plaster finish is desired for either floors or walls.

GF 12 Colored will give the wear, finish and appearance of a tile floor at about one-fifth the cost. The surface is lined out in squares, and if desired a ½" or ¼" joint can be left and afterwards filled in with a cement mortar made with a black or contrasting color of GF 12 Colored.

To Secure a Polished Surface

A very beautiful colored cement finish can be obtained with very little additional expense when GF 12 Colored is used. About three or four days after finishing the work the surface may be rubbed with an electric rubber like that used for terrazzo floors. This will produce a hard, smooth, polished surface like colored marble. If a high gloss finish is desired the surface can then be treated with GF 12 Colored Wax or two coats of GF 155 Transparent which will intensify the depth of the color and make it uniform in appearance.

Integrally Coloring Lime Plaster

GF 12 Colored is used for integrally coloring lime plaster wall finish, in which case it is put into the gauging water in the same proportions as for Portland cement work. In such cases the shades of color will be brighter and more distinct than with cement and sand, due to the whiteness of the plaster and lime.

The following points must be observed in installing work with GF 12 Colored.

Do not use more than 3 gallons of water per bag of cement for wetting up.

Do not trowel off the surface too soon, as that will bring up the finer flour of the cement, which will dry and form an opaque film on the surface, partially hiding the color so that it looks patchy.

If for this reason the surface should dry out patchy, it can be made much more uniform by applying GF 155 Transparent or GF 12 Colored Wax.

It is essential that monolithic bond be obtained for floor finish to the underbed of concrete. This is obtained by thoroughly cleaning the concrete surface of all dirt, plaster, grease and other foreign matter, chipping the surface all over to a depth of about ¼", wire brushing to remove all loose particles and then using GF 400 Bonding Compound, water, and cement grout as detailed on page 75.

Work made with GF 12 Colored sets up more quickly than work made without it, so do not leave it until too late for trowelling and finishing, so that it has to be sprinkled with water to get a finish.

Trowel and finish the surface properly the first time as going back over it to re-trowel or touch-up will spoil it.

Never sprinkle dry cement over the surface to absorb the water.

GF 155 Transparent can, advantageously, be used on a GF 12 Colored surface, as it is all vehicle, but it is not advisable to use GF 155 Floor Enamel or any cement floor paint on such surfaces. GF 12 Colored decreases the porosity by densifying the mass so that the pigments and some of the vehicle of a paint remain above the surface making it tacky.

If through faulty workmanship work laid with GF 12 Colored should prove soft and dusty after drying out, it can be made hard and dustproof with GF 145 Crystalrox, without changing the color.

Proportions to Use

GF 12 Colored is mixed with the gauging water in such proportions as to use the following quantities per bag of cement, which will lay about 25 square feet of work 1" thick:

GF 12 Red	½ gallon	(10 lbs.)
GF 12 Brown	¼ gallon	(3¾ lbs.)
GF 12 Buff	¼ gallon	(4½ lbs.)
GF 12 Gray	¼ gallon	(2 lbs.)
GF 12 Blue	1 gallon	(15 lbs.)
GF 12 Green	1 gallon	(20 lbs.)

The usual practice being to use about three gallons of water per one bag batch of Portland cement floor finish, mortar or stucco, the addition of GF 12 Colored to the gauging water in the following proportions will give about the right quantities per bag of cement in the mix:

1 gal. GF 12 Red	to 6 gal. of water
1 gal. GF 12 Brown	to 12 gal. of water
1 gal. GF 12 Buff	to 12 gal. of water
1 gal. GF 12 Gray	to 12 gal. of water
1 gal. GF 12 Blue	to 3 gal. of water
1 gal. GF 12 Green	to 3 gal. of water

For cement tiles, blocks, artificial stone and all similar products made under compression with a very small quantity of water, it is necessary to know how much water is used per bag of cement and to put into that the necessary quantity of GF 12 Colored.

For such work it is preferable to use the GF 12 Colored throughout the mass, although, if desired, it can be used to color only the finish coat or face.

These quantities are sufficient to give a decided tint to the finished work, and by varying the proportions of GF 12 Colored, practically any desired shade of color or combination of colors, such as purple, orange, pink, etc., can be obtained. A black cement floor may be obtained by using about four times the quantity of GF 12 Gray that we specify.

The cost of GF 12 Colored per sq. ft. of 1″ floor finish, figuring 25 sq. ft. per bag of cement, runs about

GF 12 Red	$.060 per sq. ft. of surface
GF 12 Brown	.025 per sq. ft. of surface
GF 12 Buff	.025 per sq. ft. of surface
GF 12 Gray	.010 per sq. ft. of surface
GF 12 French Gray	.005 per sq. ft. of surface
GF 12 Blue	.38 per sq. ft. of surface
GF 12 Green	.67 per sq. ft. of surface

For cement stucco or lime plaster wall finish the cost will be from one quarter to one half the above as also for the colored face finish of artificial stone and cast cement work.

When the cement work is required to be waterproofed against water pressure, or when it is exposed to the weather, as in the case of mortar, stucco, building blocks, porch floors, etc., two pounds of GF 11 Waterproofing Powder should first be mixed with each bag of cement to waterproof integrally the mixture and the GF 12 Colored used in the gauging water in the manner before described.

Shipping Data

The net weights of GF Colored are:

GF 12 Red	20 lbs. per gallon
GF 12 Brown	15 lbs. per gallon
GF 12 Buff	18 lbs. per gallon
GF 12 Gray	8 lbs. per gallon
GF 12 Blue	15 lbs. per gallon
GF 12 Green	20 lbs. per gallon

The weights of the coloring pigments occasionally vary slightly, and as they are always used in the same volume so that the GF 12 Colored shall always have the same coloring capacity, the net and shipping weights may sometimes vary but the net weights will average about as shown above. The shipping weights are about 2 lbs. per gallon more than the net weights.

Shipped in
55 to 60 gal. barrels
30 gal. half barrels
5 gal. drums
6–1 gal. cans in case
1–1 gal. cans in case
except GF 12 Grey which is shipped in
55 to 60 gal. barrels
30 gal. half barrels
5 gal. kegs
1 gal. kegs

GF 12 COLORED WAX

Due to imperfections in laying, cement floors laid with GF 12 Colored sometimes dry out dull and patchy, or become stained by plaster, etc.

GF 12 Colored Wax, made in the same basic colors as GF 12 Colored, is supplied to remedy these defects, to make the color uniform, and to give a gloss finish. GF 12 Wax is also supplied as a transparent coating.

After the floor has dried out, which may take 4 or 5 days, the **GF 12** Wax should be rubbed over the surface with a soft rag putting on a very thin coating. Allow to remain about fifteen minutes and then rub well with a clean rag as though the intention were to rub it all off, thereby driving the wax well down into the pores.

If the wax should prove too thick or stiff it can be thinned to proper consistency by mixing into it a very small quantity of pure spirits of turpentine.

GF 12 Wax will also greatly improve the appearance of an old colored or plain cement floor.

Shipping Data
Shipped in 5 gal. drums, 1 gal. cans
Shipping weight, 10 lbs. per gal.
Covering capacity, 200 to 250 square feet per gallon.

GF LIME MORTAR ACCELERATOR (GF 13)

Any product containing calcium chloride as a base, as manufactured for use with Portland cement, has very little beneficial effect upon lime or gypsum mixtures, either as an accelerator or hardener.

GF 13 Accelerator for Lime Mortar is a liquid compounded of various chemicals other than calcium chloride, which react with lime or gypsum to accelerate the setting. They form carbon dioxides, producing crystallization of the calcium, in much the same way that GF 12 reacts with the constituents of cement

After the formation of the crystals, nothing volatile or water soluble is left in the mixture where GF 13 is used.

Lime mortar ordinarily takes from eleven to twelve hours to set. It is customary to use 150 lbs. of hydrated lime and ½ yard of sand to make the mortar for 1000 bricks with ⅜″ joints. The addition of one gallon of GF 13 to the water used for wetting up 150 lbs. of lime will cut the setting time in half. Increasing the quantity of GF 13 will still further reduce the setting time proportionately.

As GF 13 is put into the gauging water, it is best used with hydrated lime, for if put into the water used for slaking lump lime, it will cause the partial formation of the carbon dioxides before the lime has had time to hydrate properly.

If lump lime is properly slaked first, then GF 13 can be used in the gauging water just as well as with hydrated lime.

The fact that GF 13 accelerates the setting time of the mortar must be borne in mind in determining the size of the batches and the speed with which they are used in the work.

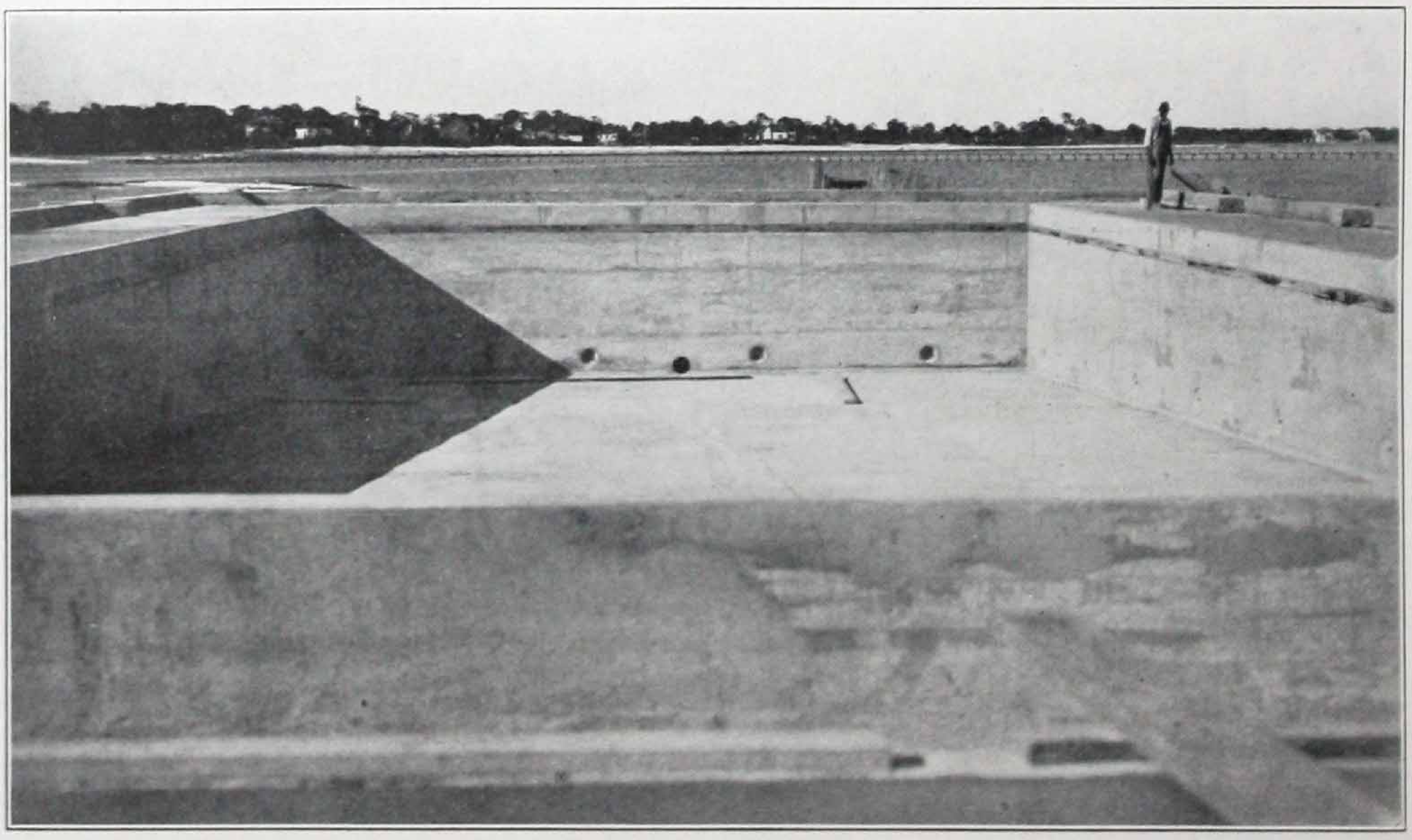
Sometimes a small percentage of hydrated lime is used with Portland cement mortar, the main object of which is to make the mixture work fatty and spread easily. The addition of one quart of GF 12 for every bag of cement in the mix will give the same results and the hydrated lime can then be omitted.

If desired, GF 12 can be used in Portland cement mortar containing a small percentage of lime, but the only beneficial results will be upon the Portland cement and not on the lime.

If a lime mortar is used, with a small percentage of Portland cement, then GF 13 should be used which will accelerate the set of the lime without much effect upon the Portland cement content.

Shipping Data

GF 13 is shipped in:—
55 gallon drums
30 gallon half drums
5 gallon drums
1 gallon cans
Shipping weight 11 lbs. per gallon.
Net weight 9 lbs. per gallon.



Swimming Pool, The Spa, St. Petersburgh, Florida. Waterproofed with GF 14 Ironcote

GF IRONCOTE WATERPROOFING (GF 14)

I Waterproofing Against Water Pressure From Outside
  1. Plaster Coat Inside

II Waterproofing Against Water Pressure From Inside
  1. Plaster Coat Inside

III Waterproofing Leaky Pits, Basements, Pools, Tanks and Reservoirs
  1. Plaster Coat Inside

IV Waterproofing, using GF Ironcote (GF 14) Only

V Repairing Damage to Waterproofing

VI Filling Cracks in Cement Surfaces

VII To Make Tight Around Pipe Passing Through Waterproof or Oilproof Plaster Coating

VIII Patching Cement Floors

GF 14 is composed of finely ground iron particles, combined with chemicals, which in contact with air and moisture, oxidize rapidly. This oxidation causes the iron to expand in volume fourfold.

When applied, GF 14 is brushed thoroughly into the pores of the surface, where it expands and tightly seals these pores so that water cannot pass through.

Covering capacity

As Ironcote wash for GF 10 plaster 1½ lbs. per 100 sq. ft.

As Ironcote waterproofing for walls, 1 lb. per 100 sq. ft. per coat.

As Ironcote waterproofing for floors, 6 lbs. per 100 sq. ft.

1 man can apply 15 lbs. of GF 14 Ironcote per day.

Shipped in 100 lb. drums.
20 lb. cans.

I-II WATERPROOFING AGAINST WATER PRESSURE FROM OUTSIDE AND FROM INSIDE

Specifications—

In the plaster coat method of waterproofing, GF 14 is used in conjunction with GF 10, and the specifications to be followed are those given in paragraphs 1 to 30, inclusive, under "GF 10," beginning on page 21.

III WATERPROOFING LEAKY PITS, BASEMENTS, POOLS, TANKS AND RESERVOIRS

Specifications—

The specifications included in paragraphs 1 to 30, given for GF 10, beginning on page 21 are to be followed.

IV WATERPROOFING, USING GF 14 IRONCOTE ONLY

In cases where the dark colored finish of GF 14 Ironcote is not objectionable the cement plaster coats specified can be omitted and the waterproof coating will then consist of from 3 to 5 brush coatings of GF 14 Ironcote applied according to the following specifications.

1—Preparation of Surface

Remove all loose parts and all foreign substance, so as to expose the underlying concrete, brick or other porous surface, in a clean condition (if oily, use acid solution) and treat with GF 400 Bonding Compound.

2—Saturation

The Surface should then be thoroughly wet with water.

3—Mixing

GF 14 should be thoroughly mixed with water to a very thin mixture (about like a very thin whitewash). Be sure the mixture is thin enough, especially the first application, as otherwise it may clog its own penetration.

4—Application

Apply the mixture, preferably with a brush, to every part thoroughly, and carefully rub it into the pores of the surface.

5—Development of Application

GF 14 will ordinarily take its initial set within from 15 to 60 minutes. The set is usually indicated by the surface appearing to become partially dry, do not let it become wholly dry, but apply moisture as soon as it begins to look at all dry. When it has set, the surface should be gently moistened, and the application of the moisture should be repeated during the first day as often as the surface becomes dry. In dry weather, the surface should be thoroughly wet twice the second day and once the third day. The second and succeeding coats may be a little thicker in mixture; but should be applied and treated practically the same as the first coat. From 3 to 5 coats are required, depending upon the water pressure behind the walls. The coats to be applied at intervals of 24 hours.

6—Against Heavy Water Pressure

Where the surface is rough, or heavy water pressure is to be encountered, it is advisable to cover the developed GF 14 surface, after thoroughly wetting same with a slush mixture of about the consistency of thick cream, composed of cement and from 15 to 25% of GF 14 mixed dry, and water. (On difficult work special instructions should be procured.)

Where pressure is encountered, it is ordinarily necessary to temporarily relieve the pressure. This is usually done by inserting bleed pipes into the walls and sinking little wells into the floor. After surrounding surface is waterproofed, these holes and wells are filled with GF 14 and cement, which completes a waterproof job.

7—Bonding

To bond new concrete to old; give the old surface a first coat treatment as above, and thoroughly develop it. Then after thoroughly wetting the surface, apply a slush mixture and follow immediately with the new concrete, etc. The slush mixture should be brushed to remove air bubbles.

V REPAIRING DAMAGE TO WATERPROOFING

Specifications—

Specifications given in paragraphs 1 to 6, 10, 15 and 33 to 36 are to be followed carefully.

VI FILLING CRACKS IN CEMENT SURFACES

8—Deep and Narrow Cracks

If very deep but narrow, say less than $\frac{1}{16}$″ wide, fill the crack as much as possible with a thin cement grout of Portland cement and water and then caulk with oakum, soaked in a thick paste made of GF 14 Ironcote and water, driven in tightly with a caulking chisel flush with the floor or wall surface.

If deep, and say ¼″ wide, caulk with oakum driven in tightly with a caulking chisel to within about ¼″ of the face. Fill in on top of this with GF 250 Grey Elastic Cement pressed well in on top of the caulking and smoothed on top, flush with the surface, with a pointing trowel. When smoothed, spread a little dry cement on top of the GF 250.

9—Deep and Wide Cracks

If more than ¼″ wide, cut the sides of the crack to a straight shoulder about 1″ deep and then sloping to a total depth of about 2″. Apply a solution of GF 400 Bonding Compound and water to the sides, making the solution by dissolving 1 lb. of GF 400 Bonding Compound in 2 quarts of water. After about 10 minutes, wash this solution off with water from a hose, and remove entirely from, and wire brush all loose particles out of, the crack.

Make a mixture of GF 14 Ironcote and Portland cement equal parts of each by weight, mixed well together dry and then wet with only enough water to make a fairly dry, but plastic mass.

Saturate the sides of the crack with as much water as they will absorb and while crack is wet ram in the mixture of GF 14 Ironcote and cement tightly, filling the crack flush with the surface and smooth off on top with a trowel.

VII TO MAKE TIGHT AROUND A PIPE OR ANY METAL OBJECT PASSING THROUGH A WATERPROOF OR OILPROOF PLASTER COATING

10—Application

Cut out all around the pipe to a depth of about 3″ forming a wedge shaped cut about 2″ wide at the top tapering down to nothing against the pipe 3″ below the surface.

Caulk around the pipe at the bottom of this cut with oakum or mineral wool soaked in GF 16 Foundation Brush Coating. Saturate the sides of the cut with as much water as they will absorb and while still wet fill in on top of the caulking all around the pipe flush with the surface of the wall or floor, with a mixture composed of equal parts by weight of GF 14 Ironcote and Portland cement mixed well together dry and then dampened with only enough water to make a fairly dry but plastic mass. Pack this tightly and evenly into the hole and turn it out on the pipe itself about ¼″ thick all around with a pointing trowel for a distance of about 2″.

Place this filling immediately before the waterproof coating is carried up to it and press the latter well into and against the GF 14 Ironcote and cement filling in the cut and all around the pipe.

The pipe must be scraped and wire brushed perfectly clean of dirt, oil or paint before putting in the GF 14 Ironcote and cement fill.

VIII PATCHING CEMENT FLOORS

If a patch in a cement floor is run out to a feather edge where it joins the old surface, this edge will soon break away under traffic.

11—Preparing Surface

The edge of the old floor where the patch is to be put in, should be cut to a straight shoulder at least ¾″ deep and the patch itself should not be less than ¾″ deep, preferably deeper.

The whole surface to be patched, including the shoulder all around, shall be treated with a solution of GF 400 Bonding Compound and water, mixed in the proportions of 2 lbs. of GF 400 to 1 gallon of water.

After about 10 minutes, remove this solution entirely from the patch, with water from a hose if possible, and a sponge or mop.

12—Preparing the Joints

Saturate the surface to be patched with as much water as it will absorb, and then cover it evenly, including the shoulders, with a dry mixture composed of equal parts by weight, of GF 14 Ironcote and Portland cement thoroughly mixed together, using this mixture in the proportion of one pint to every 15 square feet of surface.

13—Mixing the Cement

Mix the cement and sand for the patch 1 to 2½, and wet up with a solution of GF 12 and water made in the proportion of 1 gallon of GF 12 to 10 gallons of water, using not more than 3 gallons of this solution for wetting up 1 bag of cement.

Fill the patch with this mixture immediately after the application of the GF 14 and cement coating, pressing it well down and compacting it and heaping it up a little over the edges.

14—Finishing

When cement has set, cut off the surplus heaped over the edges with the side of a trowel, level off and compact the patch with a wooden float and then trowel finish in the usual manner, taking special care in floating and troweling the joint at the edges.

The surface of the patch must not be wetted with water or dusted with dry cement previous to floating and troweling.

A cement patch made in this manner will be ready for troweling and finishing in about 2 hours after placing and can be safely walked upon in 12 hours.

15—Waterproofing and Oilproofing Surface

The surface of the patch can be made waterproof, oilproof and wearproof against the heaviest kind of traffic by covering the surface before finishing, immediately after it has been levelled and floated, with a mixture of GF 140 and Portland cement, equal parts, by weight, of each mixed dry as detailed in paragraph 2, page 58.

If a metallic hardened finish is not desired, the patch can be rendered wearproof by applying to the surface, after it has set up hard and dry, 2 coats of GF 145 Crystalrox as detailed in paragraph 3, page 60.

Quantities of materials required can be estimated as follows:

GF 400 Bonding Compound	2 lbs.	per 100 sq. ft. of surface
GF 14 for patching	10 lbs.	per 100 sq. ft. of surface
GF 12 Cement Accelerator	1¼ gals.	per 100 sq. ft. of surface
GF 140 for topping	30 lbs.	per 100 sq. ft. of surface
GF 145 Crystalrox	1½ lbs.	per 100 sq. ft. of surface

GF FOUNDATION BRUSH COATING (GF 16)

I Waterproofing Against Water Pressure From Inside Only
1. Brush Coating Inside
II Dampproofing Against Seepage Below Grade
1. Brush Coating Outside
III Dampproofing Floors Below Grade
1. Brush Coating
IV Waterproofing Interiors of Concrete or Brick Containers
1. Brush Coating

Waterproofing sub-structural work against moisture and ordinary surface drainage can be done economically with a foundation brush or trowel coating. Such a coating when brushed or trowelled thoroughly into all the pores and small reveals in a brick, masonry or concrete foundation, effectively prevents the entrance of dampness or seepage except from a direct head of water pressure.

It must, however, be of such consistency to spread readily under a brush or trowel and must bond thoroughly, at the same time remaining pliant to expand or contract with the wall and not crack or scale off.

GF Foundation Brush Coating (GF 16) is a heavy bitumen paint of such consistency that it can be applied cold with an ordinary paint brush. It bonds tightly to the wall, but yields to expansion or contraction without danger to the tough film which makes up the waterproofing agent. GF 16 in connection with reinforcing layer of felt or burlap, is sometimes used to meet even more severe conditions than natural soil drainage presents.

To protect thoroughly sub-structures against surface drainage and the absorption of moisture through capillary attraction, the waterproof course must extend over the footings and on top of the underbed of the concrete floor, as well as on the outside of walls in contact with the surrounding soil. For this work the use of GF 16 is the most economical method. It does not require heating and is very easily applied.

NOTE: Where it is desired to proceed with the waterproofing before concrete or masonry walls, etc., have had sufficient time to dry out, they can be effectively dampproofed with a trowel coating of GF 250 Mastic Cement, as this material adheres perfectly to damp or wet surfaces and can be used in all such cases in place of GF 16. See Page 68.

Covering capacity of GF 16 varies from 40 to 75 square feet of surface per gallon. So much depends on the nature of the surface to be covered that a closer general estimate cannot be made.

SHIPPING DATA

Shipped in
- 1-gallon cans
- 5-gallon drums
- 30-gallon half-drums
- 55-gallon drums

Shipping weight, 9 pounds per gallon.
Net weight, 7¼ pounds per gallon.
Labor cost, One man can apply 25 gallons per day.

SPECIFICATIONS FOR APPLYING GF 16

1—Material

GF Foundation Brush Coating (GF 16), as manufactured by The Genfire Steel Co., Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized agents and delivered on the building site in original packages. It is to be applied without adulteration.

2—Preparing Surfaces

Surfaces to be coated are to be clean, dry and wire brushed to be sure that they are free from all loose particles of mortar, etc.

3—Drainage

Whatever water is present must be carried away by drainage or pumping so as to maintain the work in an absolutely dry condition.

4—Application

After the surfaces have been thoroughly cleaned and are absolutely dry, apply two thorough brush coats of GF 16 over the footing course and through the key.

After the foundations are built, two thorough brush coats of GF 16 are to be brushed over the outside of the wall up to grade.

5—Floors

After the rough concrete floor has been prepared, two thorough brush coats of GF 16 are to be spread over this surface, connecting with the laps through the footing. The finished floor to be laid over this coating and in no case to be less than 3″ in thickness.

WATERPROOFING TANKS, CISTERNS, ETC.

6—Application

After the surfaces have been prepared and cleaned, two thorough brush coats of GF 16 are to be applied to the side walls and floors of (name whether cisterns, tanks, etc.) and then this material is to be protected with a lining of either plaster, brick, tile or concrete to protect it against abrasion.

GF BITUMEN MOP COATING (GF 17)

- *I Membrane Waterproofing*
  - *1. Used with GF 18 Felt Membrane (See Page 46)*
  - *2. Used with GF 21 Fabric Membrane (See Page 49)*
- *II Membrane Roofing*
  - *1. Used with GF 18 Felt Membrane (See Page 46)*
  - *2. Used with GF 21 Fabric Membrane (See Page 49)*
- *III Filling Expansion Joints or Cracks in Cement Surfaces*
- *IV Protecting Brick, Cement, Plaster, Wood or Metal Surfaces from Acids, Smoke or Fumes*

In a great many cases where substructural work must be waterproofed against considerable hydrostatic head with no permanent drainage system to carry off the water, a heavy waterproof mat is necessary. This mat has no structural strength in itself and must, therefore, be supported by a concrete slab or brick retaining wall of sufficient strength to withstand the hydrostatic head.

A membrane used under such conditions must be tough, pliable and totally impervious to water or any acids which might be held in solution. Unless it is also elastic so as to expand or contract with the structure, breaks may occur from settlement or expansion changes.

GF Bitumen Mop Coating (GF 17) is a heavy bitumen used as a base for building up membrane waterproof courses. It is free from such elements as residuum oils, resin, etc., which have no permanent waterproofing value because they become brittle and crack in contact with water or moisture. GF Mop Coating remains elastic at zero and will not run or slide at 110 degrees Fahrenheit. It repels water, ammonia solutions, hydrochloric and sulphuric acids and saturated solutions of sodium chloride.

It must be melted before using and applied hot and is used over GF Foundation Brush Coating (GF 16) which aids in bonding. GF 16 is especially important when waterproofing in cold weather or over concrete surfaces.

The physical properties of GF 17 are:

Weight per gallon	8.71 lbs.
Specific gravity at 60° Fahr	1.05
Melting Point B. & R	150° to 165° Fahr.
Flash point	500° Fahr.
Ignition point	550° Fahr.
Volatility 50 Gr. 5 hrs. 325° Fahr	1.0%
Penetration:	
32° Fahr.—200 gr.—60 Sec.	10
77° Fahr.—100 gr.— 5 Sec.	25–40
115° Fahr.— 50 gr.— 5 Sec.	75–100
Penetration of Residue 77° Fahr	20
Ductility 77° Fahr. 5 cm. per min	20 cm.
Ductility 32° Fahr. 5 cm. per min	4 cm.
Evaporation 320° Fahr. 7 hours	0.09%
Loss 20 gr., 5 hours 325° Fahr	0.05%
Soluble in:	
Carbon Disulphite	99.8%
Carbon Tetrachloride	99.8%
86 Naphtha	68%
Analysis:	
Ash	Trace
Sulphur	2.2%
Paraffin	0.7%

Shipping Data

Shipped in 50 to 55 gal. drums 435 to 480 lbs. each.
Shipping weight 9 lbs. per gallon.

SPECIFICATIONS

For Applying GF 17

1—Material

GF Bitumen Coating (GF 17), as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased from the manufacturers or their authorized agents, and delivered on the building site in the original sealed packages. It must be applied as received, without addition or adulteration of any kind, except as directed.

2—Quantities

The following quantities of GF 17 are required for waterproofing:

2 ply work	13 gals. per 100 sq. ft. of surface
3 ply work	17 gals. per 100 sq. ft. of surface
1 single mop coat	5 gals. per 100 sq. ft. of surface

3—Preparation of Surface

All surfaces shall be carefully pointed and wire brushed to remove any loose particles and foreign matter.

If there is any grease or dirt present, the surface shall be scrubbed with benzine so as to remove this matter and leave the surface in a perfectly clean condition.

4—Membrane Waterproofing

GF 17 to be used with either GF 18 Felt Membrane or GF 21 Fabric Membrane for this class of waterproofing. For detailed instructions and specifications see page 46 (GF 18) and Page 49 (GF 21).

5—Membrane Roofing

GF 17 to be used with either GF 18 Felt Membrane or GF 21 Fabric Membrane. Specifications given under these products pertaining to membrane roofing should be followed carefully.

FILLING EXPANSION JOINTS OR CRACKS IN CEMENT SURFACES

6—Preparation

All expansion joints and cracks to be wire brushed and scraped out clean and dry.

If the cracks are very narrow they are to be cut out to a width of not less than ½" and to a depth of at least one inch. If the crack or joint extends right through the thickness the opening at the bottom is to be tightly filled with oakum or mineral wool soaked in hot GF 17.

7—Application

Pour in hot GF 17 until the expansion joint or crack is filled level with the surface and as soon as cool smooth off on top with a trowel and dust dry cement on top.

PROTECTING BRICK, CEMENT, PLASTER, WOOD OR METAL SURFACES FROM ACIDS, SMOKE OR FUMES

Because of the prevalence of acids and chemical agents in the industrial processes of the present day, either in solution or in the form of smoke, gas or fumes, it is necessary to apply some form of protective coating to masonry, concrete, wood or steel exposed to their action, and to acid containers and vats.

The one liquid coating least affected by inorganic or mineral acids, which are very destructive to most materials entering into building construction, is pure, refined bitumen. GF 17 is a refined bitumen analyzing 99.8% pure. *It does not protect against oil.*

GF 17 is applied hot, with a mop or brush, for protection against the following acids, etc.;

Alum
Ammonia
Cabbage
Chlorides
Hydrofluoric Acid
Hydrochloric Acid
Malt
Mineral Acids
Nitric Acid
Picric Acid
Sauer Kraut
Sulphuric Acid

SPECIFICATIONS

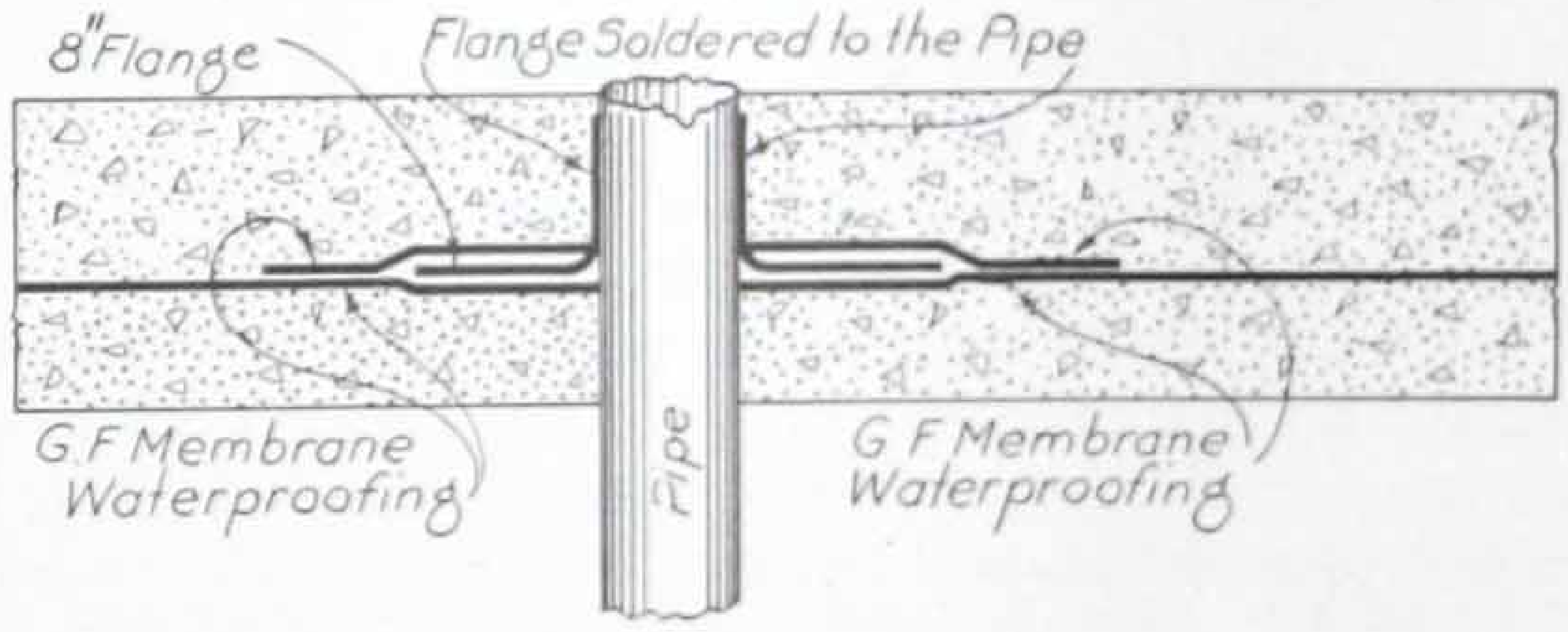
For Using GF 17 for Protection against Acids, Smoke, etc.

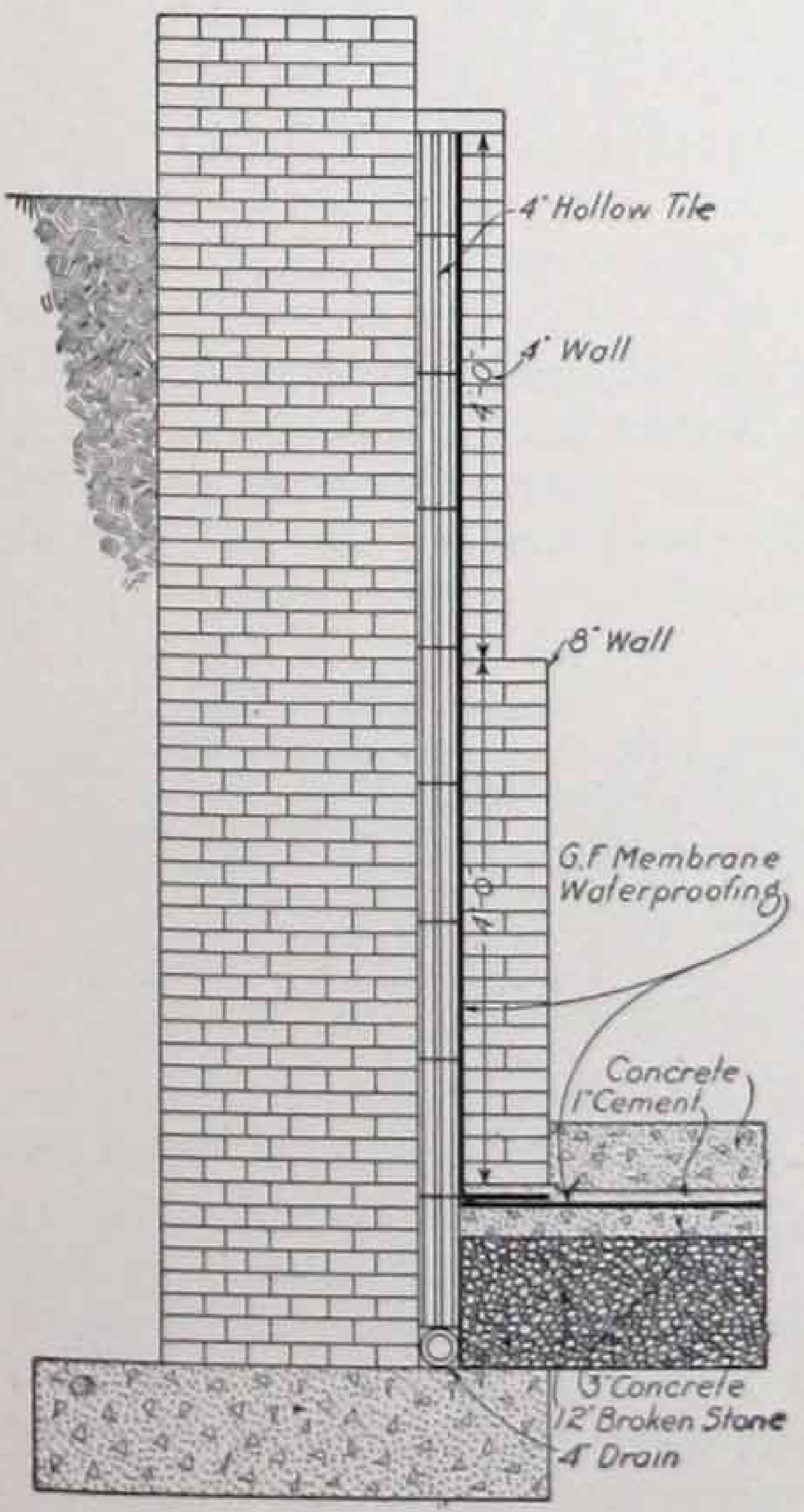
Paragraphs 1 and 2 to be followed carefully and

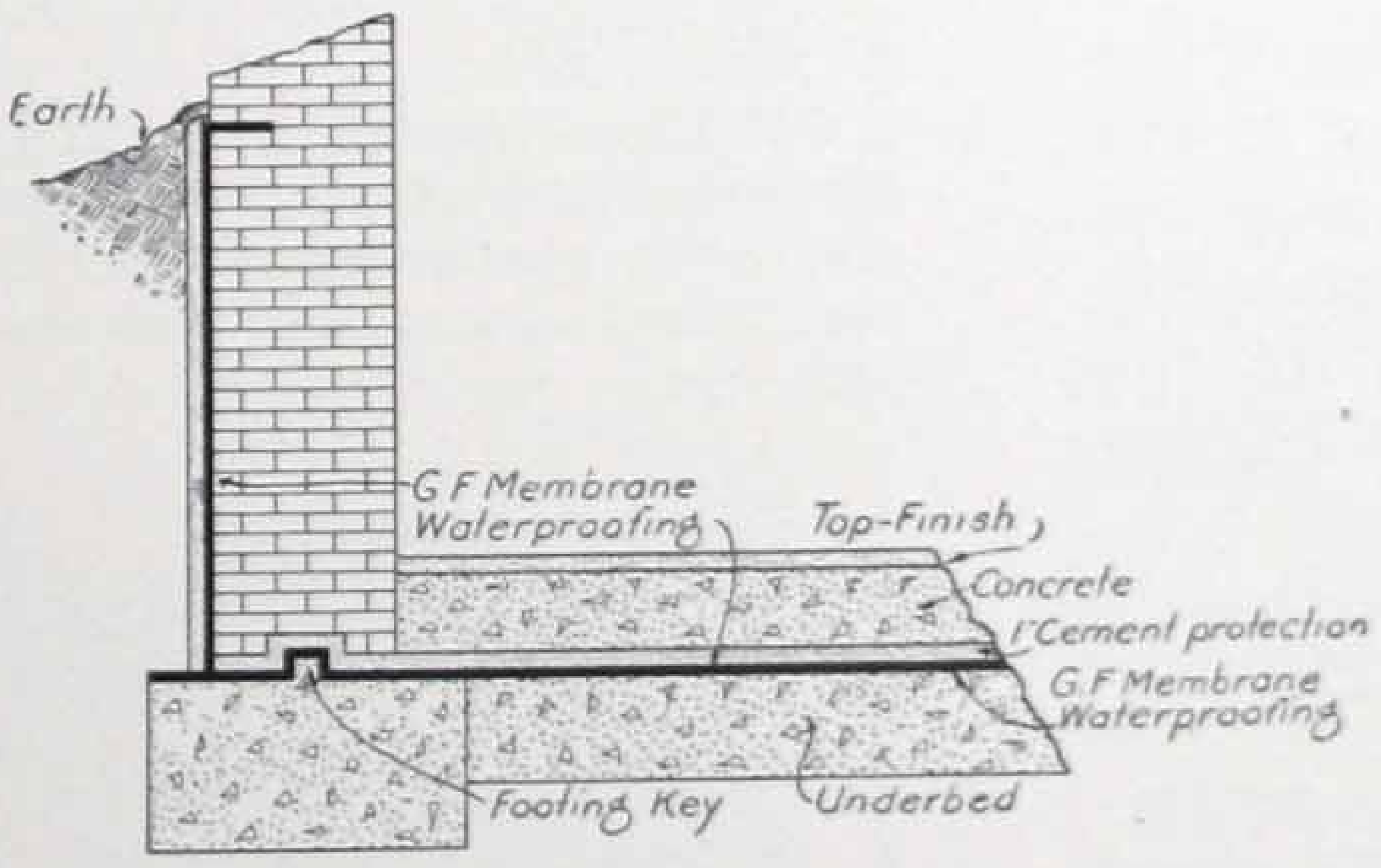
8—Application

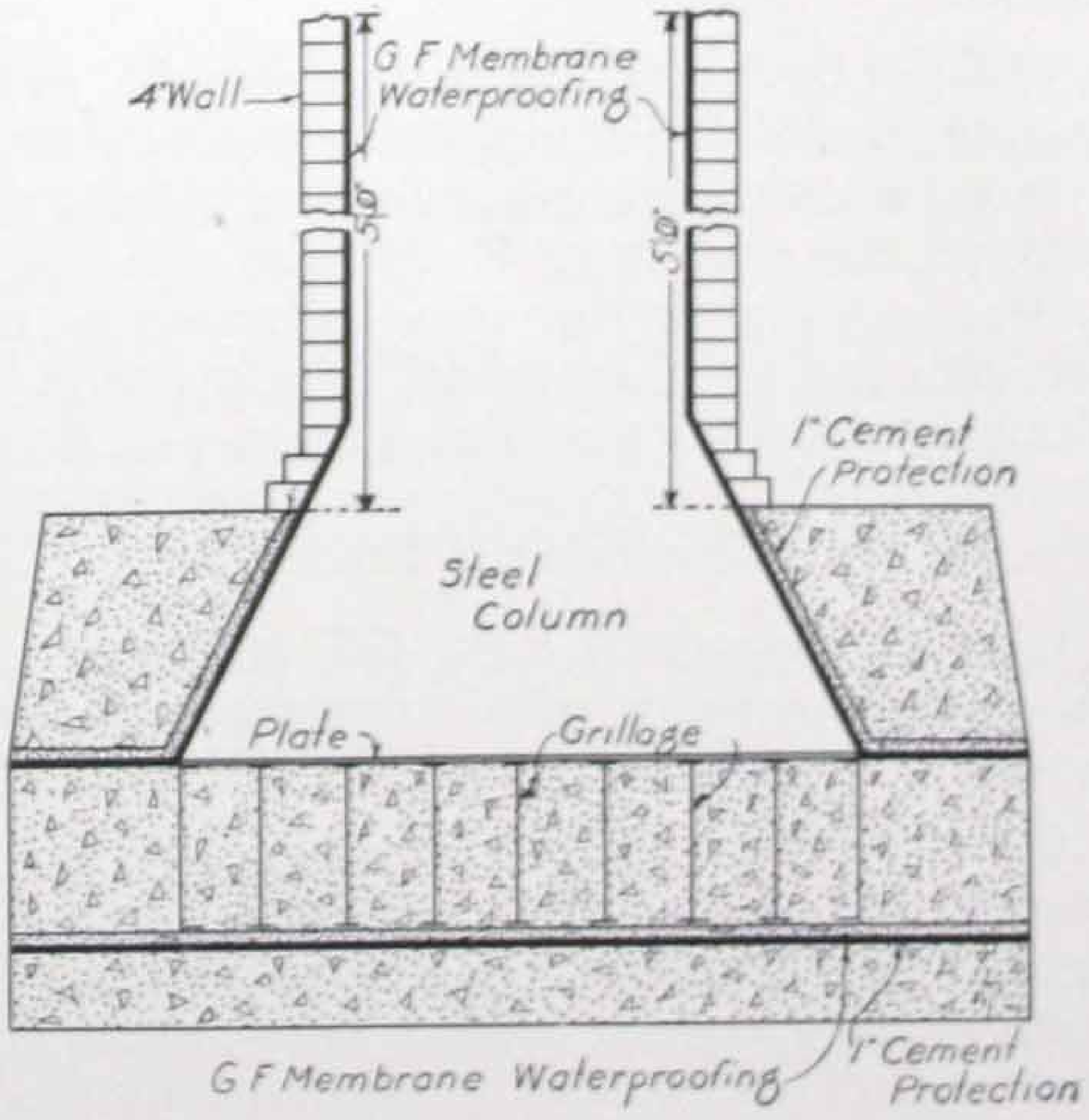
Apply one liberal coating of hot GF 17 taking care that the film fully covers the entire surface.

The surfaces shall not be subjected to the action of the acid fumes until the coating is set dry and hard.


8" Flange
Flange Soldered to the Pipe
G.F. Membrane Waterproofing
Pipe
G F Membrane Waterproofing







GF WATERPROOF FELT (GF 18)

I Waterproofing Against Water Pressure From Outside
II Waterproofing Against Water Pressure From Inside
III Waterproofing Floors
IV Built-up Membrane Roofs
V Repairing Leaky Roofs

For certain classes of modern construction the integral method of waterproofing—incorporating a waterproofing medium into the construction materials themselves—is unsuited. Deep foundations and structures erected upon piling or a comparatively soft soil will develop settlement cracks. Vibration of heavy machinery in basements and on upper floors, or of traffic passing over bridges and viaducts will cause vibration cracks. Integral waterproofing will not sufficiently increase the structural strength to prevent such cracks.

In such cases it is necessary to employ an elastic, built-up membrane waterproofing, composed of alternate layers (or plies) of felt or fabric and bitumen. The bitumen consitutes the real waterproof protection, the plies of felt or fabric between merely acting as reinforcement, like the steel bars or expanded metal in reinforced concrete construction.

Membrane waterproofing, being elastic has not sufficient rigidity in itself to remain in place, or to resist water pressure from the under or rear side. On the outside of foundation walls, the pressure of the back fill is sufficient to retain it on the surface of the walls but when applied to the inside faces of such walls or over floors below grade, it must be backed up with a concrete or brick retaining wall and a concrete floor of sufficient strength to resist any water pressure that may be exerted upon the underside of the waterproofing. In the case of upper floors, a wood floor, or concrete of sufficient thickness not to crack or lift, is sufficient protection.

The bitumen used must be of a high melting point so that it will not become brittle in cold weather or fluid in hot weather. It must also be free from organic or vegetable matter which will impair its waterproofing qualities.

The felt or fabric, as the case may be, must be of the greatest tensile strength and elasticity so that it will stretch, without tearing, over any cracks that may develop in the masonry. Each fibre must be thoroughly impregnated with the same bitumen as used for the hot coating so that when the latter is applied the whole forms a homogeneous mass.

GF WATERPROOFING FELT (GF 18)

GF Waterproofing Felt (GF 18) is a strong, water-repelling felt, made of all rag stock possessing great tensile strength and bitumen absorptive properties.

GF 18 should not be confused with the ordinary "tar paper." Instead of simply being dipped, it undergoes a complete saturating process so that every fibre is thoroughly coated and *impregnated* with bitumen. This process, as compared with the dipping method, removes all brittleness, makes the felt pliable and elastic under all temperature conditions and protects it completely against water, acids and alkalies.

Three plies of GF 18 membrane waterproofing are equivalent to five plies of felt and pitch in tensile and waterproofing strength.

Shipping Data

Shipped in rolls of 400 sq. ft. each.
Shipping weight 60 lbs. per roll.

NOTE: In estimating waterproofing allow 10% more than actual measurements to provide for laps and connections.

SPECIFICATIONS

For waterproofing with GF Bitumen Mop Coating (GF 17) and GF Waterproof Felt (GF 18)

1—General Conditions

The waterproofing course to consist of three plies or layers (or as many plies as may be necessary for the particular work in hand) of GF Waterproof Felt (GF 18) each ply stuck and coated with GF Mop Coating (GF 17), applied hot. This waterproofing course to be carried across all wall and column footings, both interior and exterior, under all floors and partitions, including the side walls and floor of all pits, and up all walls in contact with the ground to grade level.

2—Materials

GF Mop Coating (GF 17) and GF Waterproof Felt (GF 18) as manufactured by The Genfire Steel Co., Youngstown, Ohio, are to be purchased direct from the manufacturers or their authorized agents, and delivered on the building site in original packages.

3—Priming Coat

All surfaces shall first receive a thorough brush coating of GF Foundation Coating (GF 16), applied cold, to give a bond for the hot GF Bitumen Coating (GF 17).

4—Preparing Angles

To prevent breaking, the waterproofing course shall not be applied to right angled surfaces, such as the junction between floors and walls, before such angles are sloped or coved with cement to form a firm and even bed for the application of the waterproofing. Before applying the waterproofing over a right angle corner of brick or concrete masonry, the corner shall be chipped off and smoothed up with cement mortar to give a round turn.

5—Applying Waterproofing to Footings and Through Key

After masonry surface has been thoroughly dried and cleaned of projections and foreign matter, the surface of the footing is to be brushed with **GF 16** and then swabbed with hot **GF 17**. In this is to be embedded **GF 18** of sufficient width to extend 6″ on either side of the wall line. Continue this alternate swabbing and embedding of **GF 18** until full three plies have been laid and each coated with **GF 17** through this footing and key.

6—Wall Waterproofing

First—The 6″ lap left on the outside of the wall line is to be turned up and sealed to wall with a swabbing of **GF 17**.

Second—After the masonry surfaces have been thoroughly dried and cleaned of projections and foreign matter, an under coat of **GF 16** is to be applied over the entire surface to be waterproofed. After this coat has set, the surface to the width of one sheet of **GF 18** is to be thoroughly swabbed with a good, even coat of **GF 17**, applied at such a degree of heat that it does not lump, but spreads evenly, after which a layer of **GF 18** is to be immediately imbedded in this hot coating and carefully pressed down so that there are no wrinkles or ridges.

Third—Swab this layer of **GF 18** with a thorough coating of **GF 17**, then lay another thickness of **GF 18** over the full width of the sheet already placed, and mop this thoroughly with another coating of **GF 17**.

Fourth—The next layer of **GF 18** is to be lapped two-thirds of its width over the preceding layer and is to be mopped in the same manner.

This method of procedure is to be continued until the whole surface is covered. After the entire surface to be waterproofed has been covered, all flashings and joints made, the entire top surface of the **GF 18** is to receive a thick mop coating of **GF 17**, applied hot, using one gallon of **GF 17** to 25 square feet of surface.

7—Application of Four Plies or More

With the exception of the direction of the layers, the preceding instructions for application are to be followed. Where four plies are used, lay two plies and two plies at right angles; where five plies are used, three plies and two plies at right angles.

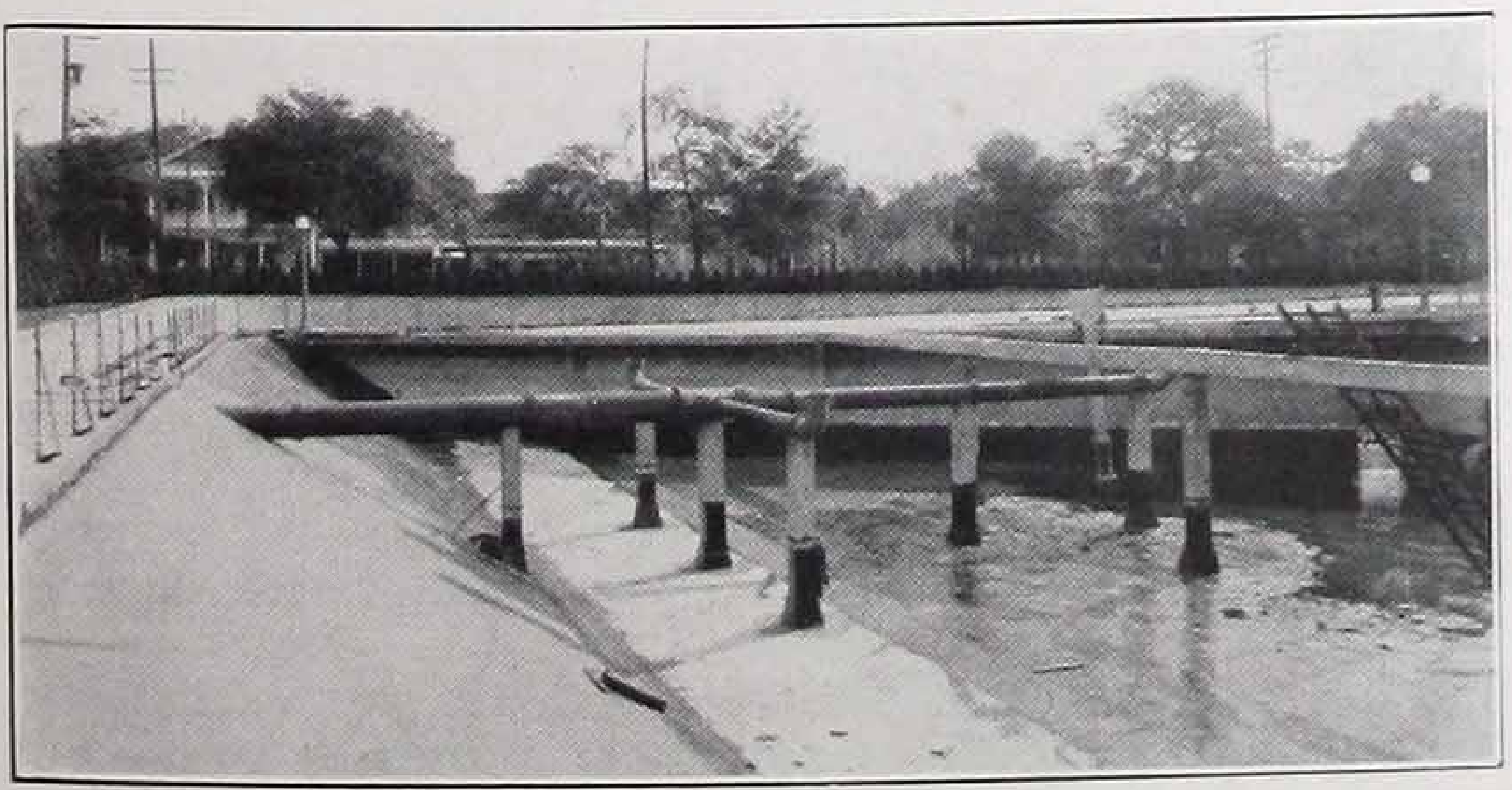
8—Laying Waterproofing Over Floors

After the concrete underbed has been cleaned, all depressions pointed up with mortar and the surface is perfectly dry, the waterproofing shall be laid as heretofore specified, great care being taken that tight joint is made between this layer and the footing lap left extending on the inside of the wall.

9—Protection of Waterproofing

After the waterproofing course over the floor and up the side walls has been finished, it shall be protected with a 1″ coat of 1:2 cement mortar applied directly over the last swabbing of **GF 17**.

A single course of brick may be used to protect the side wall waterproofing. In case brick is used, great care should be taken in laying this brick to be sure that the waterproofing course is not punctured. If possible, the brick work should be offset 1″ from the waterproofing course and this opening poured full of cement grout.



Municipal Reservoir, Jacksonville, Fla.
GF Membrane Waterproofing

10—Waterproofing Under Grillages

After the surface to be waterproofed has been cleaned and before the grillages are set, the specified number of plies of waterproofing are to be laid on the bed where these grillages are to be set, extending the Waterproofing out over the full size of the column footing. The whole layer of waterproofing is to be thoroughly protected with 1″ of mortar.

11—Waterproofing Around Columns

After the underbed of floor concrete is properly graded and smoothed off with Portland cement mortar and the rivet heads are all plastered, the waterproofing is to be laid over the entire floor, extending same up columns to a height of 2 to 5 feet (if necessary to extend higher, system previously mentioned should be used), protecting the same with 1″ of mortar. Then build 4″ of brickwork or concrete against waterproofing of columns and lay finish course of concrete over the floor.

12—Filling Column Shoes

After the columns are set, the shoes are to be filled solid with Portland cement grout, the rivet heads plastered over even and smooth and the underbed of floor concrete properly smoothed and graded with Portland cement. Then lay the waterproofing over the floor, connecting it to the lap under the grillages and extend the waterproofing up the columns to the desired height above the floor (which should be at least 12″ above the highest water level).

13—Protecting Brickwork

Then build protecting brickwork against the waterproofing around the column at least 8″ in thickness for the first 4′ in height and 4″ in thickness for the balance. After this work is completed the finish course of concrete may be laid over the entire floor.

14—Connecting Waterproofing to Pipes, Conduits, Etc.

All pipes, conduits, etc., passing through the waterproofing are to have copper flanges extending 8″ out on floors and 5″ up on pipes or conduits. After waterproofing is installed, these flanges are to be placed with the under sides stuck to the waterproofing with hot **GF 17** and then soldered to the conduits or pipes. Apply over these flanges three plies of waterproofing solidly stuck to the flanges, coated and extended 8″ out on floor waterproofing.

15—Flanges for Hot Water and Steam Pipes

In the case of hot water or steam pipes the flanges must be of iron and the pipes threaded so that the flanges can be screwed onto the pipes using red lead to render the screw joints watertight. After the flanges have been screwed in place, they shall be waterproofed with three piles of waterproofing solidly stuck to the flare of the flange and waterproofing carried out over the floor at least 8″.

WATERPROOFING SWIMMING POOLS AGAINST INSIDE AND OUTSIDE PRESSURE

Paragraphs 1 to 9 inclusive are to be followed, and

16—Application

In this construction a continuous waterproofing course must be carried under and over the floor; up the inside and outside of walls. The outside wall course shall be laid over footings before walls are placed, then carried up outside. The under-floor waterproofing should be laid on the underbed and protected before the concrete slab is poured.

The waterproofing inside the pool should be laid continuously over the floor and up the side wall. This waterproofing must be protected with plaster, brick, tile or enameled brick.

The concrete wall must be heavy enough to withstand either the inside or outside pressure.

Great care must be taken to connect the membrane very carefully to all pipes, dowels, drains or other obstructions to form a continuous course, by means of flanges as described in Paragraphs 14 and 15.

WATERPROOFING SWIMMING POOLS TO RESIST INSIDE PRESSURE

17—Application

The waterproofing course is to be carried over the floor and up the sides of the pool, extending it under the platform around pool and up the walls at the side of this platform at least 6″. Then the waterproofing is to be covered with a 1″ coat of mortar before the concrete floor and inner lining of the pool are placed.

18—Pipes

All pipes or drains passing through the waterproofing course are to have copper or screw flanges in accordance with Paragraphs 14 and 15.

WATERPROOFING THE INTERIORS OF BASEMENTS, PITS AND POOLS

Paragraphs 1 to 9 and 14 to 16 inclusive to be followed, and

19—Protection of Waterproofing

The waterproofing course on floor, walls and columns shall be protected with a 1″ coat of 1:2 cement mortar applied directly to the last swabbing of GF 17.

The wall and column waterproofing shall then be reinforced with a brick or concrete retaining wall of sufficient strength to resist the hydrostatic pressure. Great care to be taken not to injure the waterproofing, and all joints are to be well filled with mortar, using a shove joint, each course to be bedded, and particular care being taken to fill solidly the joint between the brickwork and the waterproofing.

The floor waterproofing to be reinforced with a concrete floor (1:2:4) reinforced if necessary to withstand the hydrostatic pressure.

This concrete floor to be laid before the retaining wall is built, a key being left at the walls to prevent slipping.

WATERPROOFING FLOORS OF MILLS, GARAGES, STABLES, ETC.

20—Wood Floors

If gutters are required, wooden boxes are to be constructed at least 2″ wider and 2″ deeper than the depth and width of the iron gutters, so that there may be a space for applying the waterproofing. Over the wood underfloor lay one ply of GF 18, lapping the edges 2″ and nailing well with flats and nails. Then apply the number of layers of waterproofing to be used in accordance with Paragraphs 6 to 10 inclusive, extending this course down and around sides and bottoms of gutter boxes. After the iron gutters are installed, fill in under them with hot GF 17 so that the space is filled solid.

21—Laying Sleepers for Finished Floor

The sleepers for the finished flooring are to be laid and nailed at the same time the surface coating of GF 17 is being applied, the carpenters working with the waterproofers to the end that the sleepers may be embedded in the hot GF 17, and a complete bond made between the coating and the nail so there will be no leak where the nail punctures the waterproofing course.

22—Concrete Floors

Form depressions in the concrete underbed for iron gutters which are to have copper flanges on either side at least 6″ wide. These gutters are to be set so they will come to the proper level in relation to the finished floor. After the underbed of concrete is properly smoothed and graded with Portland cement mortar lay the waterproofing over the entire floor in accordance with Paragraphs 6 to 10 inclusive, including the depressions for the gutters.

23—Setting Gutters

Set the gutters so the flanges will rest upon the waterproofing and fill space under the gutters solid with GF 17. Then bring the copper flanges of the gutters down upon the waterproofing, nailing these flanges at least every 6″. Then lay three plies of waterproofing the full width of the flanges, lapping 8″ out on floor waterproofing.

24—Protecting Waterproofing

Protect the entire surface of the waterproofing with 1″ Portland cement mortar and after this has thoroughly set, lay the finished concrete floor.

DAMPPROOFING AGAINST SEEPAGE AND NATURAL SOIL DRAINAGE

25—Materials

GF Bitumen Coating GF 17 as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased direct from the manufacturers or their authorized agents and delivered on the building site in original packages. It is to be applied without adulteration.

26—Preparing Surfaces

All surfaces to be coated are to be clean, dry and free from all loose particles of mortar, etc.

Wherever water is present it must be carried away by drainage or pumping so as to maintain the work in an absolutely dry condition.

27—Application

GF 17 must be applied (with an ordinary cotton yarn mop) at such a degree of heat that it will not lump when it comes in contact with cold masonry. The material must be kept at a temperature ranging from 250 to 300 degrees in the "kettle" in order to be of proper consistency.

After the surfaces have been cleaned and are absolutely dry, apply two thorough covering coats of GF 17 over the footing course and through the key, in the following manner:

First—Coat the entire footing with GF 17 and imbed in this coating (while hot) a layer of GF 18, allowing same to lap at least 6″ either side of the wall lines.

Second—Coat this GF 18 with a thorough coating of GF 17, taking care that the GF 18 is not displaced in the operation.

Third—After the foundation wall is set in place, the lap on the outside of the footing is to be turned up and stuck to this wall with a coating of GF 17, after which two thorough covering coats are to be mopped over the outside of the wall up to grade.

28—Connection to Lap

Great care must be taken that a perfect connection is made to the lap through the footing.

29—Floor

After the rough concrete floor has been prepared, mop two thorough covering coats of GF 17 over this surface, connecting with the laps through the footings.

After this has been done, the finish floor is to be laid over this coating. (The finish floor in no case to be less than 3″ in thickness.)

BUILT-UP ROOFS

In cases where a built-up membrane roof covering is desired, GF Mop Coating (GF 17) is used in conjunction with either GF Waterproofing Felt (GF 18) or GF Saturated Fabric (GF 21).

SPECIFICATIONS

30—Application

All roof surfaces shall be dry and swept clean and all joints and cracks pointed up. Before GF 17 is applied to any concrete or masonry surface a priming coat of GF 16 shall be used.

The roofing shall consist of 3 plies of GF 18 Bitumen Saturated Felt and GF 17 Bitumen Coating.

The GF 18 shall be laid singly with one third of the width of each ply exposed and each ply shall be stuck to the under surface and coated on top with GF 17 applied hot.

All connections to flashings, etc., shall be made with laps of at least 6″ which shall be cleaned and dried.

If laid upon a wood foundation the under coat of GF 17 shall be omitted. Each ply shall be nailed with roofing tins and nails spaced 6″ apart along the edge and about 2 feet apart in the center, care being taken that these nails and tins are well covered with the hot GF 17 Coating.

GF SATURATED FABRIC (GF 21)

USED WITH GF 17 BITUMEN MOP COATING

I *Waterproofing Against Water Pressure From Outside*

II *Waterproofing Against Water Pressure From Inside*

III *Waterproofing Wood Floors*

IV *Built-up Membrane Roofs*

V *Repairing Leaky Roofs*

VI *Waterproofing Steel Deck or Concrete Floor Bridges*

On work where it is advisable to use Membrane Waterproofing, the development of even a slight leak would cause a great deal of damage, and very often the natural vibration of some structures or their expansion and contraction are so great that a waterproof felt will not withstand the strain.

Under such conditions a fabric must be used that is exceptionally elastic, expanding in any direction without breaking, and with enough tensile strength to resist a considerable head of water, in case there is a split in the backing wall or floor. Bridge decks, above-grade swimming pools and similar structures require this class of waterproofing, and as there are often a great many sharp angles to turn, the fabric must be flexible enough to fit snugly without cracking.

GF Saturated Fabric (GF 21) consists of a heavy quality, cotton fabric so saturated with pure bitumen that every thread and fibre is thoroughly soaked with the waterproofing. This method effectively waterproofs the fabric, and preserves all of its natural tensile strength, elasticity and flexibility.

Shipping Data

Shipped in rolls 50 sq. yds. each.
Shipping weight 47 lbs. per roll.

The Physical properties of GF 21 are:

Width unsaturated	37″
Width saturated	36″
Weight unsaturated per sq. yd	5 oz.
Weight saturated per sq. yd	13 oz.
Minimum tensile strength lengthwise per lineal inch	65 lbs.
Minimum tensile strength crosswise per lineal inch	50 lbs.
Threads per lineal inch	22 to 26
Flexible	0°-250° Fahr
Stretch	10%

Two plies of GF 21 membrane waterproofing are equal in tensile and waterproofing strength to ten plies of ordinary felt and pitch.

NOTE:—*In estimating waterproofing allow 10% more than actual measurements to provide for laps.*

SPECIFICATIONS

For Waterproofing with GF Bitumen Mop Coating (GF 17) and GF Saturated Fabric (GF 21)

1—General Conditions

The specifications for the application of GF 17 and GF 21 for waterproofing against water pressure and for waterproofing wood floors are in all cases exactly the same as those for GF 17 and GF 18, except that it is not necessary to use more than two plies of GF 21, and Paragraph 4, "Preparing of Angles for Waterproofing" can be omitted, for GF 21 has sufficient tensile strength and pliability to fill such angles without cracking.

2—Materials

GF Mop Coating (GF 17) and GF Saturated Fabric (GF 21) as manufactured by the Genfire Steel Co., Youngstown, Ohio, are to be purchased direct from the manufacturers or their authorized agents, and delivered on the building site in original packages.

3—Priming Coat

All surfaces shall first receive a thorough brush coating of GF Foundation Coating (GF 16), applied cold, to give a bond for the hot GF Bitumen Coating (GF 17).

BUILT-UP ROOFS

In construction work where a built-up membrane roof covering of the highest quality is desired, GF Mop Coating (GF 17) is used in conjunction with GF Saturated Fabric (GF 21).

4—Application

All roof surfaces shall be swept clean and dry and all joints and cracks pointed up. Before GF 17 is applied to any concrete or masonry surface, a priming coat of GF 16 is to be used.

The roofing shall consist of 2 plies of GF 21 Bitumen Saturated Fabric and GF 17 Bitumen Coating applied hot.

The GF 21 Fabric shall be laid with the second layer overlapping the first for a width of 19″ and each ply shall be stuck to the under surface and coated on top with GF 17 Bitumen Coating applied hot.

At all parapet walls, bulkheads, chimneys, etc., form flashings of the same material, carried up to a height of 8″ above the roof level.

All connections shall be made with laps of at least 6″ which shall be carefully cleaned and dried before attaching the new work.

If laid upon a wood foundation, only the surface of the first layer between laps and the upper surfaces of the GF 21 shall be coated with GF 17. Each layer shall be nailed with roofing tins and nails spaced 6″ apart along the edges and about 2′ apart in the center of each layer, care to be taken that these nails and tins are well covered by the hot GF 17 coating.

WATERPROOFING STEEL DECK OR CONCRETE FLOOR BRIDGES

Paragraphs 1 to 9 inclusive, under Specifications for GF 18, are to be followed carefully, and

5—Construction

A. Depth—The depth of the steel or concrete construction shall be sufficient from the top of the rail to the top of steel or concrete floor to allow the installation of sufficient protection of concrete or brick to prevent cutting the waterproofing by the action of the ballast.

B. Drainage—The surface to which the Waterproofing is applied shall be pitched so that all water washing down through to the waterproofing may be removed promptly. Where this is not done in the steel, concrete shall be laid so as to drain the water to the inlets.

C. Inlet—Cast iron inlets shall be set at proper places in the floor and provided with movable grated covers. The down spout from these inlets shall be provided with traps and clean-outs which shall be accessible from below the bridge.

D. Half-Through Girder—Where the top of the girder approximates the same height as the top of the rail, the waterproofing and protection shall cover the entire top of the girder.

E. Apron-Plate—The apron-plate from the steel floor over the back wall shall be provided with a curb angle against which to finish the waterproofing, and to this angle shall be riveted a vertical plate to prevent dirt from collecting under the apron-plate. The apron-plate shall slide freely on the backing wall either over a flat or downward curved surface.

6—Protection of Waterproofing

After completion of the waterproofing the entire surface shall be covered and protected by one of the following methods:

First—Straight hard burned brick laid flat, with the joints filled either with GF 17 or with cement grout in which has been incorporated GF 10.

Second—A layer of concrete from 2½″ to 3″ thick with GF Expanded Metal Reinforcement.

7—Preparation for Waterproofing

A. Concrete—Wherever called for by the plans, the decks of the bridge shall be protected with 1:3:5 concrete mixed as specified and finished with 1:2 cement mortar ½″ thick, troweled to a smooth, even surface as shown. This concrete and mortar shall be allowed to dry thoroughly so as to prevent the formation of steam when the hot waterproofing is applied.

B. Cleaning—All vertical or sloping surfaces of concrete or steel shall be thoroughly cleaned of dust, dirt, loose particles, paint and grease. The use of a hand bellows is recommended for cleaning of loose sand and dirt. For cleaning paint and grease and freshening the surface of the GF 17 where a junction of old and new is to be made or where a pocket of GF 250 Mastic Cement is to be used against the girders, gasoline shall be used. This may be done either by swabbing the surface with it, or, where steel is to be cleaned, pouring a small quantity over the surface to be cleaned and setting fire to it. The use of a blow torch is also recommended.

C. Painting Steel and Concrete—The surface shall then be painted with 2 coats of GF 16. The material for the first coat shall be diluted with gasoline so as to give a brownish tint. The second coat shall leave the surface a very dark brown—almost black. Both coats of paint shall be carefully applied and thoroughly worked into the surface, to give a uniform coating.

Paint shall not be applied to damp concrete or steel. The paint is to be applied immediately in advance of the waterproofing and before dust and dirt have a chance to collect after the cleaning.

D. Pouring Concrete—All concrete shall be poured as the chief engineer shall direct. It shall be of such consistency that when placed, it will not require much tamping and shall be laid to aid the watertightness of the structure, not merely as a support for the waterproofing materials. All exposed surfaces shall be troweled to a smooth, hard finish.

In cases where concrete haunching against girders is called for by the plans, forms shall be used, and the concrete shall be of a wet consistency.

8—Application of Waterproofing

On the surface prepared as hereinbefore specified, apply GF 17 and GF 21 in accordance with Paragraphs 1 to 9 inclusive, under specifications for GF 18.

All flashing and reinforcing around inlets and other places specified shall be carefully executed.

Waterproofing shall not be done in wet weather or at a temperature below 32 degrees Fahrenheit without special orders from the chief engineer. The GF 21 shall be laid shingle fashion transversely to the center line of the bridge and shall be carried up the haunching and secured against the girder by the use of an angle bolted through the girder and over the waterproofing as shown.

The finish of the waterproofing against girders or concrete shall be made with a pocket of GF 250. The surface with which this material comes in contact shall be dry, absolutely free from grease or dust, and, previous to its application, shall be covered with a thin paint of GF 16 diluted with gasoline.

Particular care shall be taken to make a tight joint around gussets, stiffeners and the ends of girders. Care shall be taken to prevent injury in any way to the waterproofing by the passing of men or wheelbarrows over it, or by throwing any foreign material upon it.

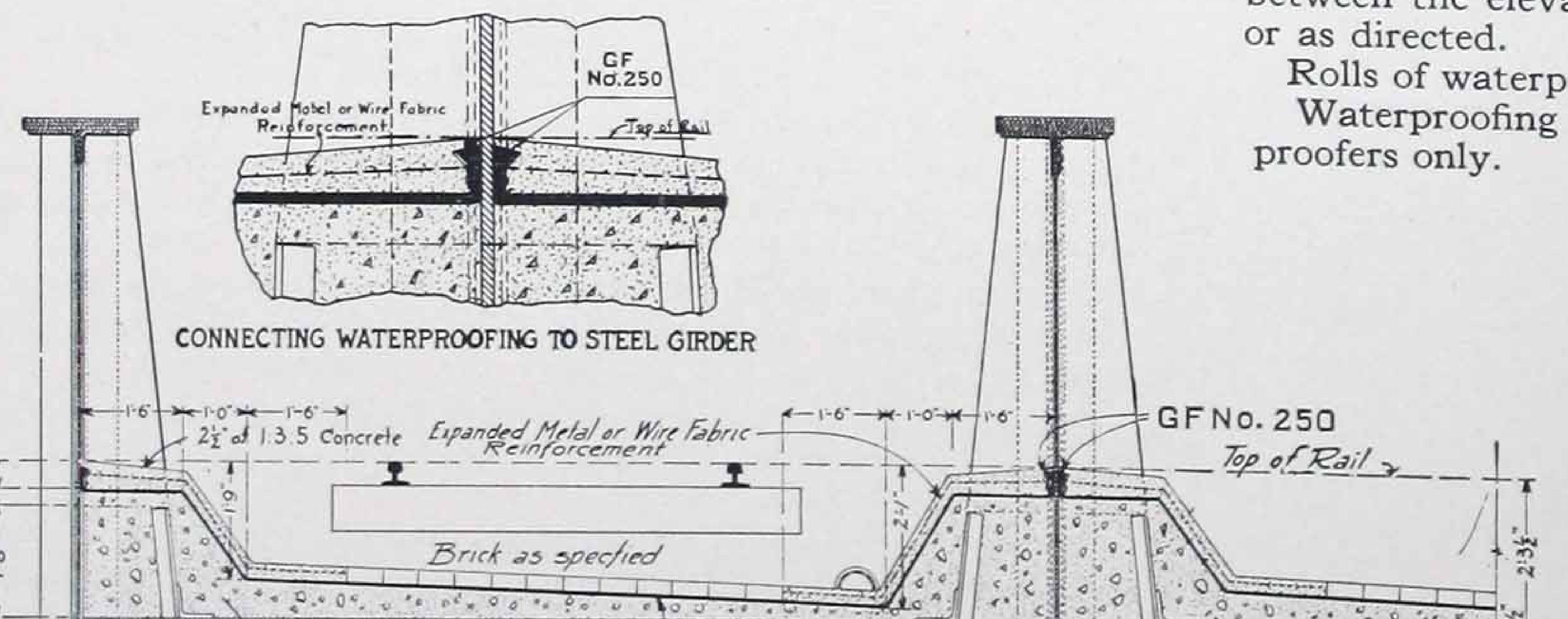
After the waterproofing course has been completed, the horizontal surfaces shall be protected by a course of straight, hard burned, dense brick, laid flat in a bed of 1:3 cement mortar with full joint. There shall be not less than ½″ of mortar between the waterproofing course and the brick.

About 18″ in width of the horizontal surface adjacent to the haunching shall be protected by about 2½″ of 1:3:5 concrete reinforced with GF Expanded Metal.

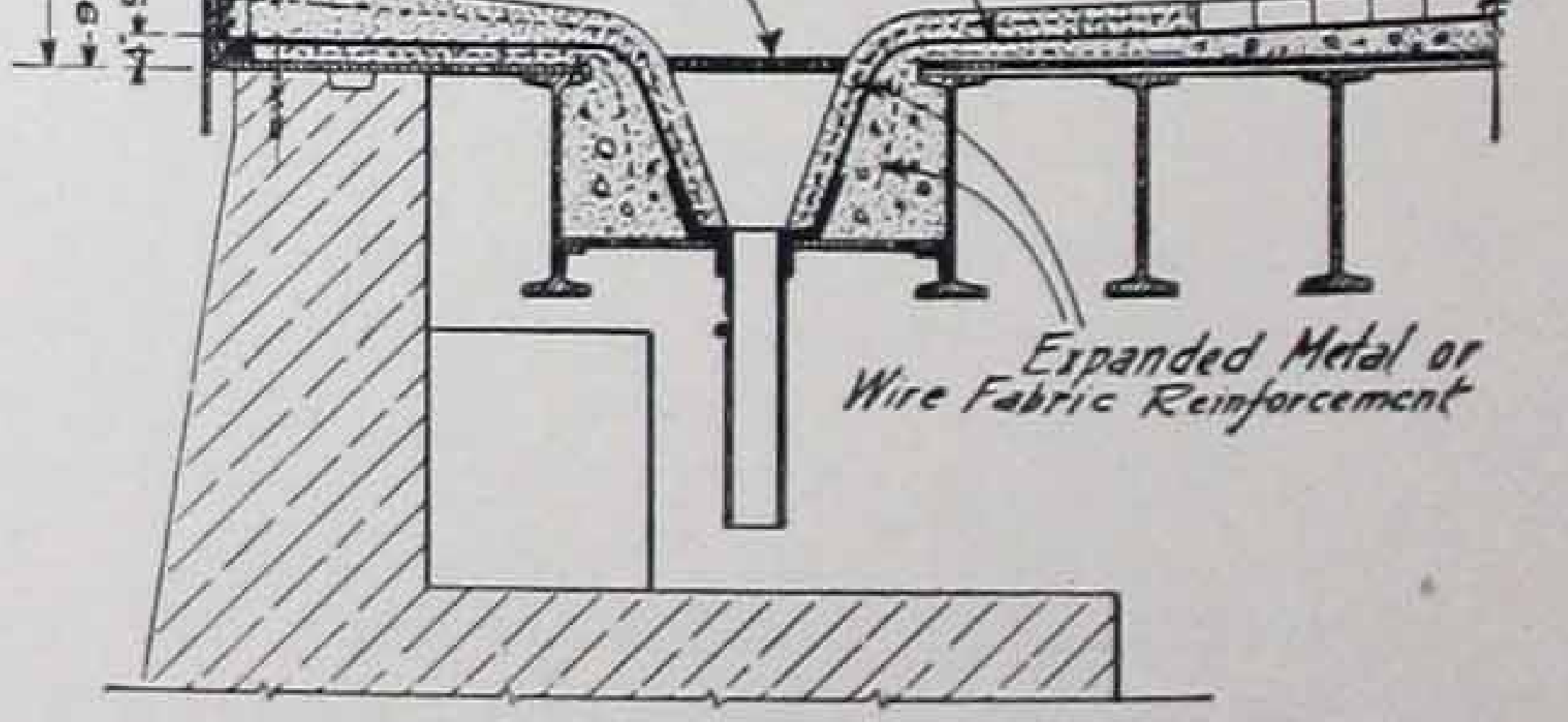
Every care shall be taken to insure satisfactory and thoroughly watertight joints between the main layer of waterproofing and girder; special attention shall be given to stiffeners, etc. The waterproofing shall also be carried down over the back walls between the elevation of the bridge seat as shown on the plans or as directed.

Rolls of waterproofing shall be stored on their side.

Waterproofing shall be done by experienced and expert waterproofers only.



CONNECTING WATERPROOFING TO STEEL GIRDER



CROSS-SECTION THRU BACK WALL

GF ACIDPROOFING (GF 99)

I Protecting Brick, Cement, Plaster, Wood or Metal Surfaces From Acids, Smoke or Fumes.

GF Acidproofing (GF 99) is a transparent coating, which applied to a cement, brick, plaster, wood or metal surface, closes it completely against the action of organic or dilute acids, smoke or alkali solutions or gases. It is chemically neutral, forming a durable film on the surface to which it adheres, but in no way reacting with it. GF 99 can be applied to either plain or colored walls and floors, metal or wood trim, rendering the surface proof against acid and destructive agencies without altering its appearance.

The action of GF 99 is really simply to interpose a film over the surface to which it is applied that will not only penetrate and fill the pores of that surface but will also adhere strongly to the sides of the pores and to the spaces in between.

GF 99 dries into a hard surfaced elastic film or covering that will expand and contract with the surface to which it is applied without checking or crazing.

GF 99 forms a durable and effective acidproofing coating against almost all the organic acids and their fumes, which are mostly those that are ordinarily encountered in manufacturing processes and also against very diluted forms of some of the inorganic or mineral acids.

GF 99 is therefore not a universal protective agent against all acids and thin fumes but it is a sure protective against the acids and alkalies enumerated in the following list and others of the same families that may not be listed below.

GF 99 protects against the following:

- Acetic Acid
- Albumen
- Alcohol
- Alkalies
- Ammonia
- Blood
- Caustic Potash, 50% Solution
- Caustic Soda, 50% Solution
- Disinfectants
- Ensilage
- Garbage
- Hydrochloric Acid, 25% Solution (Muriatic Acid)
- Lactic Acid
- Live Steam
- Malic Acid
- Molasses
- Oxalic Acid
- Picric Acid, 10% Solution
- Septic Fluids
- Sewage
- Silage
- Smoke
- Sodium Chloride
- Sugar
- Sulphuric Acid, Weak Solutions
- Vinegar
- Tannic Acid
- Wine

Covering Capacity

First coat	350 sq. ft. per gallon
Two coats, approximately	200 sq. ft. per gallon

Labor Cost

One man can apply 4 gallons per day.

Shipped in

1 gallon cans
5 gallon drums
30 gallon half-drums
55 gallon drums
Shipping weight, 9 lbs. per gallon.
Net weight 7½ lbs. per gallon.

SPECIFICATIONS

for Applying GF Acidproofing (GF 99)

1—Material

GF Acidproofing (GF 99), as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased from the manufacturers or their authorized agents, and delivered on the building site in the original sealed packages. It must be applied as received, without addition or adulteration of any kind, except as directed.

2—Preparation of Surface

All surfaces shall be carefully pointed and wire brushed so as to remove any loose particles and foreign matter.

If there is any grease or dirt present, the surface shall be scrubbed with benzine so as to remove this matter and leave the surface in a perfectly clean condition.

3—Application

After the surface has been cleaned of all foreign matter and is absolutely dry, apply not less than two coats of GF 99, brushing it in thoroughly so as to insure the covering of the entire surface and the penetration of the material as far as possible.

4—Treating Floors

If the floor surface is very dense and hard, the first coat is to be 50% pure spirits of turpentine and 50% GF 99; the second coat is to be 25% pure spirits of turpentine, 75% GF 99, and the third coat, straight GF 99.

(Note—Unless the floor is very dense in surface or texture, the spirits of turpentine is to be omitted from the second coating.)

5—Tinted Walls

After (name walls) are coated with GF Brick and Cement Coating (GF 101) and that coating has cured 24 hours, apply a thorough coating of GF Acidproofing (GF 99), following Paragraphs 1 to 3 carefully.

After applying GF Acidproofing, it is necessary for the surface to cure or dry for 4 days before using.

GF TRANSPARENT WATERPROOFING (GF 100)

I Waterproofing Against Water Pressure From Inside Only
II Waterproofing Cement Stucco
III Waterproofing Sand Lime Brick Walls
IV Waterproofing Brick, Stone, Stucco, Concrete Walls
V Waterproofing Interiors and Exteriors of Concrete or Brick Containers
VI Waterproofing Magnesite Stucco
VII Parapet Walls and Coping to be Waterproofed
VIII Preventing Efflorescence

Stucco, stone and brick exterior walls need special protection if their original color and texture are to be preserved, otherwise they will become streaked and stained. The necessary protection is afforded by GF Transparent Waterproofing (GF 100), which is easily brushed into the surface, penetrating and filling the pores and drying hard enough to prevent dirt and dust from permanently sticking to it.

GF 100 is also used on parapets, over copings, etc., where it is impractical to use a waterproofing course which changes the appearance of the surface. Swimming pools and tanks which are light in color are waterproofed against water pressure from the inside and protected against stain and discoloration through the use of this product.

GF 100 Transparent Waterproofing contains no ingredients of a waxy or paraffin nature and dries out with a firm elastic surface. After application it is unaffected by heat or cold and all dirt and dust settling upon the surface will be washed off by the next rainstorm so the surface will always be free from stains or discolorations.

GF 100 consists of a water insoluble waterproofing compound in an active volatile vehicle. The vehicle carries the waterproofing into the pores and, evaporating, leaves the waterproofing deposited in the minutest pores and bonded to their surfaces. These pores are entirely filled with a transparent water repellant compound that effectively seals the surface against the entrance of water.

Used on exterior walls of stucco or cement block GF 100 fills the pores so completely that the usual soaked appearance after rainstorms is prevented and there is no danger of frost cracks.

It prevents efflorescence on new walls and checks it on old. This condition, however, is so serious on old buildings that exact conditions should be sent to the manufacturers of GF waterproofing products and they will recommend the proper method of treatment in detail.

GF 100 is never to be applied when the temperature of the surface is below 60° Fahr.

GF 100 should be used only upon surfaces that have never been previously coated. An old coat of paint or wax can never be entirely removed and any that remains in the pores will prevent proper penetration of the GF 100.

The covering capacity of GF 100 varies inversely with the porosity of the surface to which it is applied, but is approximately as follows:

Covering Capacity

First coat	100 to 150 sq. ft. per gallon
Second coat	200 to 250 sq. ft. per gallon
Two coats	80 to 100 sq. ft. per gallon

(Note—Where the surface covered need not retain its original color, a cement wash applied prior to the waterproof coating will increase the covering capacity of GF 100. This serves to diminish the number of pores, cracks and holes too small to be cared for by the "pointing up" process.)

Labor Cost

One man can apply 5 gallons per day, or GF 100 can be applied by a spray.

Shipping Data

Shipped in
1 gallon cans
5 gallon drums
30 gallon half-drums
55 gallon drums
Shipping weight 8 lbs. per gallon.
Net weight 6½ lbs. per gallon.

SPECIFICATIONS

For applying GF Transparent Waterproofing (GF 100)

GENERAL

1—Material

GF Transparent Waterproofing (GF 100) as manufactured by The Genfire Steel Co., Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized agent, and delivered on the building site in original and sealed packages. It must be applied as received without adulteration of any kind.

2—Application

The best results from the application of GF 100 are obtained when the temperature is about 70 degrees Fahrenheit. It must never be applied when the temperature of the wall is below 60 degrees Fahrenheit.

3—Cleaning

The surface should be carefully wire brushed to remove all loose particles of mortar and any other foreign matter, including dust.

4—Pointing

Before GF 100 is applied, all holes, open joints, and cracks should be pointed up with GF 250 Elastic Cement so as to present an even and perfect surface over which to apply the coating. If the walls are of limestone or are faced with limestone trim, GF 252 Rubber Caulking Compound should be used in place of GF 250 Colored Elastic Cement as it will not cause any stains on the edges of the limestone with which it may come in contact. It is also very advisable to caulk all joints between window frames and walls with oakum and GF 251 Window Caulking Compound.

5—Method of Coating

In no case shall less than two coats of GF 100 be applied, and where the surface is very porous, apply as many additional coats as may be required to saturate completely the surface.

(Note—The porosity of the surfaces of brick, concrete and stucco varies considerably in parts, that is in the less porous parts the particles forming the surface are packed much closer together. There are consequently less voids on the surface of such portions which, therefore, cannot absorb as much of the GF 100 as the more porous parts. It is of course impossible to locate such spots beforehand so the result is that the superfluous GF 100 will remain in the form of a film on the surface of these spots. This film will, however, dry out and fall off after exposure for a short time to the action of the sun and elements, when the surface will present a uniform appearance over all.)

WATERPROOFING AGAINST WATER PRESSURE FROM INSIDE ONLY

WATERPROOFING CEMENT STUCCO

General Specifications contained in Paragraphs 1 to 5 to be followed

TREATMENT OF SAND-LIME BRICK OR EXTREMELY POROUS SURFACES WHERE ORIGINAL COLOR NEED NOT BE RETAINED

Paragraphs 1, 2, 3 and 4 are to be followed carefully, and

6—Preparation of Surface

The wall shall be drenched with clear water and while still wet, a thin cream made from Portland cement and water is to be brushed thoroughly over this surface. As this coating is for the purpose of filling up the small cracks and holes too small to be pointed, great care must be taken that the cement cream is brushed thoroughly into all such voids.

7—Application

After this cement wash has hardened thoroughly and is absolutely dry, brush off such of it as refuses to adhere strongly to the wall. Then proceed with the application of the GF 100. (See Paragraph 5.)

(Note—The fact that the GF 100 is designed as a small pore filler and transparent coating, explains why the application of a cement wash is advisable, when the surface is very open and porous, for the material itself has not enough body to fill a hole or a crack large enough to admit a knife blade.)

ROUGH BRICK, CEMENT, STUCCO OR CONCRETE WALLS TO BE WATERPROOFED

Paragraphs 1 to 4 inclusive are to be followed carefully, and

8—Application

Two thorough saturating coats of GF 100 (or as many more as may be necessary to fill the pores thoroughly) are to be applied to all surfaces exposed to the weather. This means the roof faces of the parapet walls and the copings, if there are any, and then down the outside faces of the walls to grade level. Twenty-four hours are to be allowed to elapse between coats.

EXTERIOR OR INTERIOR SURFACES OF CONCRETE OR BRICK CONTAINERS TO BE WATERPROOFED

Paragraphs 1 to 4 inclusive are to be followed carefully, and

9—Application

Paragraphs 3 and 4 to be followed carefully. Apply to the interior surface of the container to be waterproofed, two coats of cement wash of cement and water, mixed to the consistency of a thin cream. After this has cured, brush off all material that does not adhere strongly to the wall or floor, and apply not less than two coats of GF 100, allowing twenty-four hours between coatings.

(Note—The coating should be allowed to set as long as possible before it is subjected to pressure on the inside of the tank, as it takes several days for it to reach its maximum strength.)

The exterior surfaces of all concrete or brick containers exposed to the weather should be waterproofed to prevent absorption of water which will cause spalls and cracks from which leaks will develop even if the interiors are waterproofed.

MAGNESITE STUCCO

Leaky magnesite stucco walls are rendered dampproof by pointing up all cracks with GF 250 Colored and then thoroughly coating with either GF 100 Transparent Waterproofing or GF 160 Preservative.

Owing to the great porosity of magnesite stucco more than two coats are generally required to render the surface nonabsorbent.

PARAPET WALLS AND COPING TO BE WATERPROOFED

Paragraphs 1 to 4 are to be followed carefully, and

10—Application

Apply to both sides of parapet walls not less than two coats of GF 100, carrying this coating from the cap flashing up the back of the parapet over the coping stone and down the exterior side of the parapet wall to at least 6″ below where the dampproofing or furring on the interior face of the wall ceases.

CHECKING EFFLORESCENCE ON WALLS

Paragraphs 1 to 4 inclusive are to be followed carefully, and

11—Preparation of Surface

Brush off all powder excrescence on the surface with a wire brush and GF 400 Bonding Compound (2 lbs. GF 400 in 1 gallon of water). Wash the surface thoroughly with water, from a hose if possible, so as to remove all the GF 400.

When the surface has dried out thoroughly, which may take two or three days, point up all cracks and open joints with GF 250 Colored Elastic Cement and then apply two coats of GF 100 thoroughly brushed into the surface.

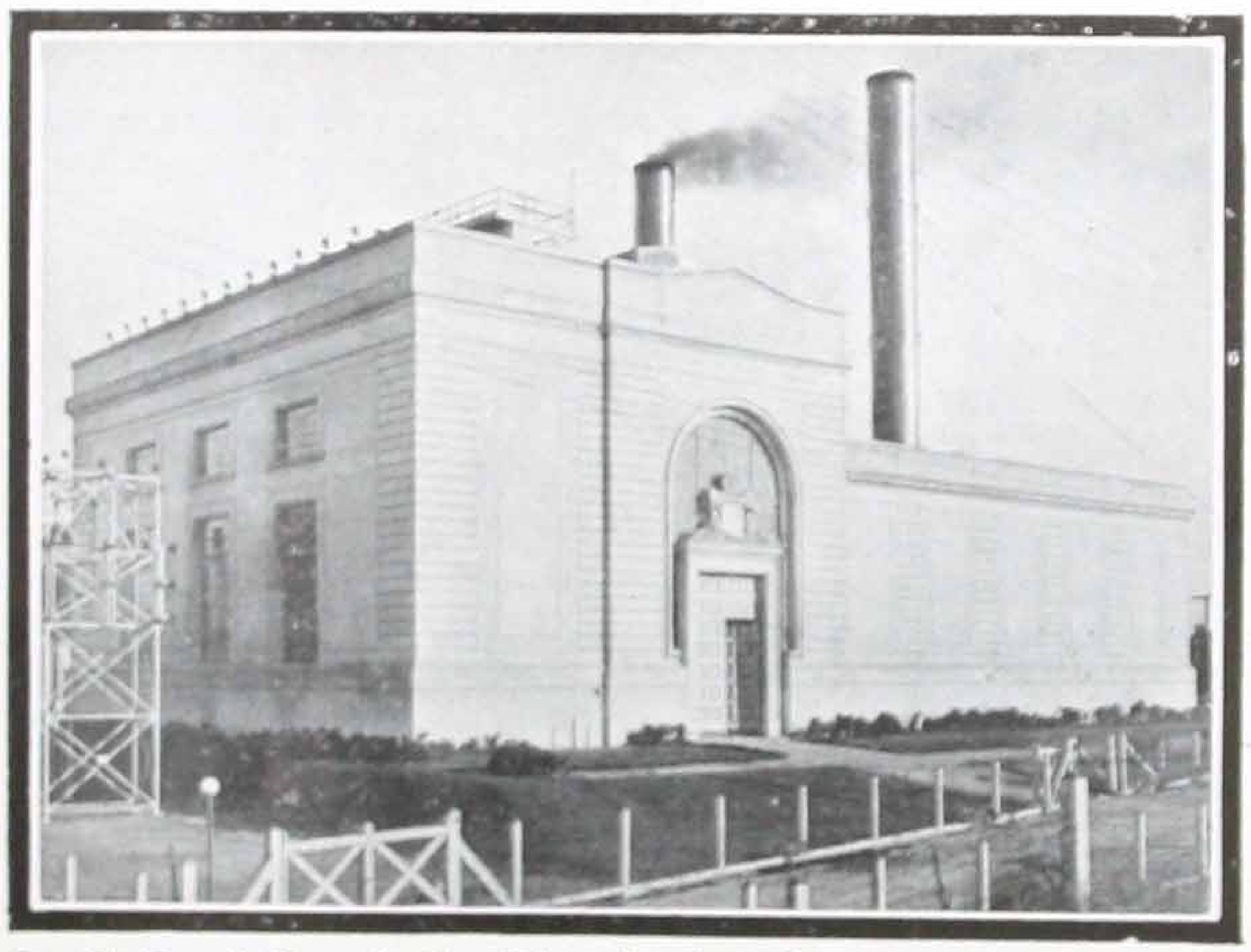
Caulk around all door and window frames with oakum and GF 251 Window Caulking Compound.

If all moisture in the wall has not dried out before the GF 100 is applied, it will come to the surface, under the action of the sun, bringing with it the alkalies of the cement and sand, thereby forming fresh efflorescence on the surface.

Such spots should be treated in exactly the same manner and the treatment repeated as often as necessary, which in the case of thick walls may be three or four times, that is until all the moisture has evaporated out of the walls.

Because efflorescence is brought to the surface by moisture, it is essential that all possible points of ingress for moisture, such as copings, backs of parapet walls, etc., should be closed by treating those parts in exactly the same manner.

Country Home of Stoughton A. Fletcher, Indianapolis, Ind., GF Colorless Waterproofing (GF 100) used for exterior walls. Architects, H. L. Bass Co., Indianapolis. Contractors, Latham & Walters, Indianapolis.



Pacific Gas & Electric Co., River Station, Sacramento, Calif. GF Colorless Waterproofing (GF 100) for exterior.

Northwestern Life Insurance Company Building, Milwaukee, Wisconsin. GF Dampproof Coating (GF 200) used. Architects, Marshall & Fox.

Youngstown Sheet & Tube Company Houses, Youngstown, Ohio. GF Brick and Cement Coating (GF 101) used on exteriors. Architects, Conzelman, Herding, Boyd, St Louis, Mo. Contractors, Unit Construction Co

GF BRICK AND CEMENT COATING (GF 101)

I Waterproofing Brick, Stone, Stucco, Concrete Walls
1. Colored Coating
II Waterproofing Sand Lime Brick Walls
1. Colored Coating
III Waterproofing Cement Stucco
1. Colored Coating
IV Waterproofing Magnesite Stucco
1. Colored Coating
V Waterproofing Interiors of Concrete or Brick Containers
1. Colored Coating
VI Preventing Efflorescence
1. Colored Coating
VII Roofings and Repairing Leaky Roofs
1. Colored Coating
VIII Decorating and Protecting Walls and Ceilings
1. Colored Coating
IX Painting Exterior Cement Floors
1. Colored Coating

The widespread development of stucco and cement exteriors for buildings of every character has created a demand for a coating which can be successfully used over such surfaces, not only to waterproof the walls, but to preserve their texture and equalize the uneven appearance due to variation in material and application; in many cases also to add a color or tint for artistic effect.

Ordinary paint with linseed oil cannot be used satisfactorily over masonry surfaces. The oils combine immediately with the alkalies in the cement, forming a saponified compound, which is soluble in water, and rainstorms will soon destroy this coating.

Efforts have been made to overcome these troubles by the use of various chemicals intended to change alkali into an inert material, but the varying density of each wall meant that a different solution was necessary for different parts of the surface. Where the solution was not sufficient to neutralize the alkaline action, it weakened the bond of the cement and chipping and scaling of the paint film and cement was the result.

Other experiments have been made with solutions of various materials such as zinc, alum, etc., but these also weaken the bonding power of the cement, and at the same time introduce moisture under the surface which must be allowed to evaporate thoroughly before any coating can be applied. A linseed oil film, unless the oil is polymerized, will in a short time develop many microscopic holes, formed by the dissipation of the foots and impurities naturally present in the oil, through which water will easily penetrate. China wood oil contains no such impurities and the resultant film is absolutely and permanently waterproof.

Graphite, lampblack, ochre and all coloring pigments of a similar nature will greatly hasten corrosion of metal, while chromate pigments will check corrosion as evidenced by the results of tests by Cushman, Gardner and other recognized paint experts.

GF Brick and Cement Coating (GF 101) is the result of careful research and scientific analysis. The pigments and vehicle are not affected in any way by the constituents of cement—they have, in fact, a decided affinity for them. This coating is both waterproof and decorative; can be applied to brick, tile and stone as well as cement, and penetrates the pores to such an extent that it becomes an integral part of the surface without in any way destroying its texture. It overcomes any lack of uniformity in surface shading, and gives a soft, flat finish of the desired color. GF 101 is composed of China wood oil with a small percentage of polymerized linseed oil. Only chromate coloring pigments are used.

GF 101 will adhere tenaciously, and sets hard enough to resist the action of the elements. Yet it retains the elasticity necessary to conform to expansion or contraction stresses in the wall itself.

Colors

Furnished from stock, either flat or gloss finish, as follows:

White
Ivory White
Cream
Buff
Bedford Gray
Portland Gray
Concrete Gray
Light Red
Dark Red
Brownstone
Moss Green

Covering Capacity

First Coat..........125 to 150 sq. ft. per gallon
Second Coat.........200 to 250 sq. ft. per gallon
Two Coats.......... 85 to 100 sq. ft. per gallon

Labor Cost

One man can apply 5 gallons per day.

Shipping Data

Shipped in	Shipping Weight
1-gallon cans	18 pounds per gallon
5-gallon drums	Net 16½ lbs. per gallon
30-gallon half-barrels	
50-gallon barrels	

SPECIFICATIONS

for Applying GF Brick and Cement Coating (GF 101) General

1—Material

GF Brick and Cement Coating (GF 101) as manufactured by The Genfire Steel Co., Youngstown, Ohio, must be purchased from the manufacturers direct or from their authorized agents. The material must be delivered on the site in original packages and applied according to the manufacturer's direction.

2—Stirring

The GF 101 must be thoroughly and frequently stirred to keep the pigments in suspension. Neglect of this precaution will result in an uneven coating which will greatly mar the appearance of the finished work.

If the GF 101 should later work too thick it may be thinned by adding a little GF 101 Liquid or a very small quantity of pure spirits of turpentine.

Surplus liquids should be poured off into another container. The contents of the can must be thoroughly stirred, adding the liquid poured off until it is all returned. To avoid evaporation, simply keep the can covered when not in use.

3—Preparation of Surface

The surface to receive this coating must be clean, dry and any particles of foreign matter must be removed by wire brushing or scraping before the coating is applied, and all cracks pointed up with GF 250 Elastic Cement.

If the walls are of limestone or faced with limestone trim, GF 252 Rubber Caulking Compound should be used in place of GF 250 Colored Elastic Cement as GF 252 Rubber Caulking Compound will not cause any stains on the edges of the limestone with which it may come in contact.

To avoid leakage through the joints between window frames and walls they should be caulked with oakum and GF 251 Window Caulking Compound.

4—Priming Coat

For priming coat over new and unpainted surfaces, add 1½ pints of GF 101 Liquid to each gallon of GF 101, which is equivalent to adding 1 gallon of GF 101 Liquid to each 5-gallons of GF 101. This priming coat is to be brushed well into all pores of surfaces.

5—Preparation of Previously Painted Surfaces

A surface that has been previously painted with GF 101 must be thoroughly wire brushed so as to remove all loose particles. Any other previous paint coatings must be entirely removed, which is best done with either a blow torch and scraper or a reliable paint and varnish remover.

6—Weather Conditions

Owing to the nature of GF 101, weather conditions must be considered. A temperature of 70 to 80° F. is most favorable and it must not be applied when the temperature is below 60° F. To obtain the best results it should not be applied at a time of excessive humidity.

7—Application

Apply first a priming coat composed of 1½ pints of GF 101 liquid to 1 gallon of GF 101, brushed well into the surface and allow 24 hours to dry out. Then apply at least two coats of GF 101 of the desired color with an interval of 24 to 48 hours between coats. Two coats of GF 101 are necessary to obtain an even colored job. Additional coats, when necessary, are to be applied at the same interval between each.

Wherever a tank or a container is waterproofed the coating should be permitted to cure for at least three days before the receptacle is filled with water. If the work is done during damp or muggy weather, even a longer period should elapse.

CHECKING EFFLORESCENCE ON WALLS

Paragraphs 1 to 7 inclusive are to be followed carefully and

8—Preparation of Surface

Brush off all powder excrescence on the surface with a wire brush and GF 400 Bonding Compound (2 lbs. GF 400 in 1 gallon of water). Wash the surface thoroughly with water, from a hose if possible, so as to remove all the GF 400.

When the surface has dried out thoroughly, which may take two or three days, point up all cracks and open joints with GF 250 Colored Elastic Cement and then apply two coats of GF 101 thoroughly brushed into the surface. Caulk around door and window frames with oakum and GF 251 Window Caulking Compound.

If all moisture in the wall has not dried out before the GF 101 is applied, it will come to the surface, under the action of the sun, bringing with it the alkalies of the cement and sand, thereby forming fresh efflorescence on the surface.

Such spots should be treated in exactly the same manner and the treatment repeated as often as necessary, which in the case of thick walls may be three or four times, that is until all the moisture has evaporated out of the walls.

Because efflorescence is brought to the surface by moisture, it is essential that all possible points of ingress for moisture, such as copings, backs of parapet walls, etc., should be closed by treating those parts in exactly the same manner.

PAINTING EXTERIOR CEMENT FLOORS

When it is desired to paint cement floors of porches or tennis courts, or concrete roof decks, a primer coat of GF 101 liquid mixed with GF 101, as above detailed, should be first applied, and then two coats of GF 101 Brick and Cement Coating.

GF CEMENT PAINT (GF 102)

I Decorating Interior and Exterior Surfaces of Brick, Concrete, Tile or Stucco Construction
II Painting Basement Walls, Refrigerators and Places where there is Moisture in the Air
III Painting Interiors of Swimming Pools

It is sometimes desirable to decorate the interior or exterior surfaces of brick, concrete, tile or stucco construction with something better and more durable than cold water paint or whitewash, and yet not so expensive as an oil paint which has to be specially made to withstand the saponifying action of the alkalies contained in these materials.

A fitting decorative coating for such a purpose is one made of Portland cement, but cement alone used in the form of a wash will dust or flake off, especially when exposed to dampness.

GF 102 Cement Paint is a dry powder, composed of Portland cement and other ingredients, together with coloring pigments, so that it can be mixed with cold water, and applied with an ordinary whitewash brush to any kind of masonry or cement surface, interior or exterior, walls or ceilings. It contains nothing that will putrefy or breed bacteria, such as glue or casein that form the basis of most cold water paints.

GF 102 Cement Paint adheres firmly to the surface, is water insoluble after it has set and dried so it will not dust or wash off, and can be applied to the surface of a damp wall or ceiling. It gives a rough finish that resembles colored cement or masonry. Later, if desired, any oil paint made for cement or masonry surfaces, can be applied to a surface that has been coated with GF 102 Cement Paint.

GF 102 Cement Paint is suitable for basements, refrigerators, packing houses, paper mills and plants where there is moisture in the air, as it may be applied to a wet surface. It is especially applicable for decorating the interior or exterior surfaces of stucco buildings of a temporary nature, such as exposition, fair or amusement park buildings, for retaining walls, reinforced concrete bridges, etc.

GF 102 Cement Paint is especially adaptable for painting the interiors of swimming pools, as the presence of the clear water in the pool enhances the soft shades of color of the GF 102. In such cases it must be borne in mind that the full depth of the GF 102 color is not discernible until the pool is filled with water.

Colors

GF 102 Cement Paint is made in White, Ivory, Brownstone, Cream, Buff, Bedford Gray, Portland Gray, Concrete Gray, Light Red, Dark Red, Light, Medium and Moss Green.

Covering Capacity

One gallon (consisting of 10 lbs. of GF 102 in 2½ quarts of water) will cover about 200 square feet of surface one coat, or 125 square feet two coats. One man can apply 15 gallons per day.

Shipping Data

Shipped in
5 gallon drums 1 gallon cans
Shipping Weight 12 lbs. per gallon
Net Weight 10 lbs. per gallon

SPECIFICATIONS

For Applying GF Cement Paint (GF 102)

1—Material

GF Cement Paint (GF 102) as manufactured by the Genfire Steel Co., Youngstown, Ohio, must be purchased from the manufacturer direct or from their authorized agents. The material must be delivered on the site in original packages and applied according to the manufacturer's directions.

2—Preparation of Surface

The surface to which GF 102 Cement Paint is to be applied must be cleaned and wire brushed to remove dirt, dust and all loose particles.

Saturate the surface thoroughly with water but do not apply the cement paint to a wall, where water is actually seeping through from the outside, as this will wash off the cement paint before it has set.

3—Mixing

Mix the GF 102 Cement Paint powder thoroughly with water in the proportion of 10 pounds of the dry powder to 2½ quarts of water. This will make one gallon of paint of a heavy pasty consistency which can be applied easily with an ordinary paint brush.

Mix only enough GF 102 with water that can be applied in one hour (about two gallons to each man) as two hours after mixing it will be too hard to be applied.

4--Application

Apply with brush, thoroughly covering the surface. Allow twenty-four hours for the first coat to set and dry, then saturate the surface again with water before applying the second coat.

In very warm or dry weather, the surface of the GF 102 Cement Paint should be sprayed with water while the paint is setting.

GF METALLIC HARDENER (GF 140)

I Integrally Hardening and Wearproofing Cement Floors

Cement floors or walks, no matter how carefully laid, will almost invariably dust up when subjected to wear, or deteriorate under the action of oil and grease, unless some special precaution is taken. Without this protection rapid deterioration of the floor or sidewalk results, and considerable damage is caused by the dust which rises. This dust works its way into the most carefully guarded bearings of machinery, and is particularly harmful to textiles of all kinds.

The most permanent and economical method of preventing these conditions is to incorporate a hardening element into the surface of the finished floor, using GF Metallic Hardener (GF 140).

The use of GF 140 in no way alters the method of laying the floor, for it is simply sifted on evenly after the cement top finish has been laid. The result is a hard, wear-resisting, dustproof and oilproof surface.

GF 140 is a finely ground iron of definite grading rendered not easily water absorbent by the addition of a material which waterproofs the surface of each particle and prevents initial corrosion or oxidation which may occur in transit or storage, because of dampness in the air or on the ground.

Finely ground iron particles in contact with air and moisture oxidize rapidly, thereby increasing four times in volume. When the mixture of GF 140 and cement is placed upon the wet surface the cement in the mixture bonds to the wet cement below. The action of troweling grinds the particles of GF 140 into the cement and water, the temporary waterproof coating is destroyed, the iron particles oxidize and in expanding, are bonded perfectly together by the intervening cement so that the whole coating becomes monolithic with the surface to which applied.

It is obvious, that if not temporarily waterproofed, the particles of iron would very likely become oxidized before being used. The result being that the value of their expansive and consequent bonding action would be lost before they could be applied to the surface to be hardened.

Covering Capacity

Covering capacity, 15 lbs. GF 140 per 100 square feet of surface for ordinary conditions of wear. Under exceptional conditions 20 to 30 lbs. per 100 square feet of surface.

Colors

Made in either grey or red.
Shipped in 100 lb. bags.

SPECIFICATIONS

For Applying GF Metallic Hardener (GF 140)

1—Material

GF Metallic Hardener (GF 140) as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased direct from them or their authorized agents. The Hardener must be delivered at the building site in original packages, and used in strict accordance with the manufacturer's directions.

2—Method of Using

Lay the cement topping in the usual manner, using not more than 3 gallons of water per one bag batch and screed level.

GF 140 should be mixed with an equal volume of Portland cement (that is one bag of GF 140 with one bag of cement) so that the two are equally combined and when the mixture is struck with the flat of a shovel no dark streaks appear.

An easy way to ensure the proper distribution of the GF 140 over the surface is to take a small box or can and determine the number of times it is contained in a mixture of 1 bag of GF 140 and 1 bag of cement. This will show how many square feet of surface one box or can full of the mixture must cover. Divide the floor surface into sections containing the area that each box or can full will cover and let the mason spread that quantity evenly over that area. For instance, one bag of cement and one bag of GF 140 contains 56 quart cans full, so one quart can of this mixture will contain 1.8 lbs. of GF 140. 1 quart can of GF 140 and cement, therefore, will cover:—

@ 10 lbs. GF 140 per square 18 sq. ft.
15 lbs. GF 140 per square 12 sq. ft.
20 lbs. GF 140 per square 9 sq. ft.
25 lbs. GF 140 per square 7 sq. ft.
30 lbs. GF 140 per square 6 sq. ft.

When screeded, float the surface free from hollows or bubbles, and spread over it, by means of a fine hand screen, 30 pounds of the dry cement and GF 140 mixture (or 40 pounds to 60 pounds for exceptionally heavy wear) so that it is spread evenly and smoothly over the surface with no bare spots.

3—Finishing

When, after the usual lapse of time, the floor is ready for finishing, work the surface well with a wooden float, and then finish with a steel trowel, in the usual manner, to a smooth dense finish. The floor must not be finished too soft as that will cause the GF 140 to become buried in the soft surface below. Neither must it be left too long, so that it becomes necessary to sprinkle water to get a finish, as that means the cement below is set and the GF 140, therefore, cannot bond and the coating when dry, will scale off.

4—Monolithic Floors

When floor finish is laid monolithically with the concrete arch, screed the surface carefully and float so as to bring the cement and sand to the surface.

Make a mixture composed of one bag (100 lbs.) of GF 140, 2 bags of Portland cement and 3 bags of clean sharp sand.

Distribute this whole mixture evenly over 1000 sq. ft. of surface and float level.

Make a mixture composed of 2 bags (200 lbs.) of GF 140 and 2 bags of Portland cement and spread this uniformly over the above mentioned coating for the same area of 1000 sq. ft. immediately after the previous coat is floated.

This method necessitates the use of
1st coat 10 lbs. of GF 140 per 100 sq. ft. of surface
2nd coat 20 lbs. of GF 140 per 100 sq. ft. of surface
Total 30 lbs. of GF 140 per 100 sq. ft. of surface

GF METALLIC OILPROOFING (GF 141)

I Oilproofing Concrete Vats and Tanks
II Oilproofing Concrete Floor and Wall Surfaces

GF 141 Oilproofing is a finely ground pure iron powder that is easily water miscible. It contains chemicals which on contact with air and moisture cause the iron flour to oxidize very quickly, increasing in volume fourfold.

The GF 141 is applied to the surface of the concrete and penetrates into the pores, where it oxidizes. Expansion of the iron effectively seals the pores, forming a dense surface through which oil cannot penetrate.

Covering Capacity

2 lbs. of GF 400 Bonding Compound per 100 sq. ft. of surface.
10 lbs. of GF 141 Oilproofing for 5 coats per 100 sq. ft. of surface.

Labor Cost

One man can apply about 15 lbs. of GF 141 Oilproofing in one day.

Shipped in

100 lb. drums
20 lb. cans

SPECIFICATIONS

Waterproofing and Oilproofing Tanks, Floor and Wall Surfaces With GF 141 Oilproofing

1—Preparation of GF 141 Oilproofing

Four pounds of GF 141 Oilproofing are to be mixed with one gallon of water. It is not advisable to mix a larger quantity at one time, as this product is not water soluble, and the mixture must be stirred every time the brush is dipped into it to keep the GF 141 in suspension.

2—Preparation of Surfaces

Where there is continual water pressure from outside the walls or below the floor, this pressure must be relieved by pumping, and the work kept free from water until it is all set up hard and dry by one of the methods detailed in paragraph 21, page 23.

The surfaces must be perfectly clean and treated with GF 400 Bonding Compound dissolved in water in the proportion of 2 lbs of GF 400 to 1 gallon of water. Apply this solution liberally to the surface with a brush, allow to remain about 10 minutes, and then entirely wash off with plenty of clean water, using a hose if possible.

Wire brush the surface to remove all loose particles and then saturate with as much water as the surface will absorb.

3—Application

While the surface is wet from saturation with water as above specified, the mixture of GF 141 Oilproofing and water is to be applied by means of a brush, working the mixture well into the pores of the surface.

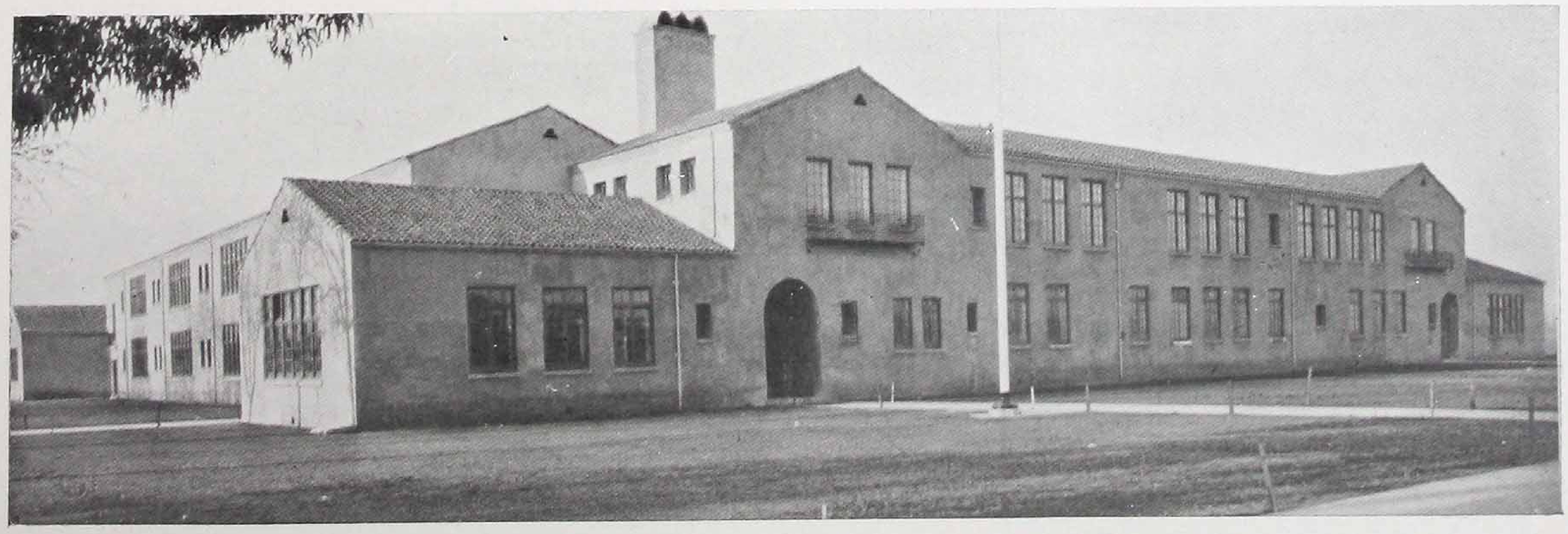
GF 141 Oilproofing will take its initial set in about one hour, which is indicated by the surface beginning to appear dry. As soon as this occurs the whole surface should be gently moistened with water shaken on with a brush, repeating as often as the surface begins to dry out.

Five coats of GF 141 Oilproofing should be applied, each coat being moistened with water as soon as it begins to appear dry as detailed in the preceding paragraph. An interval of at least 12 hours must elapse between each coat.

When applying GF 141, be sure that all angles, especially at the corners and junctions of floors and walls, are flushed full with each coating of the mixture. It is essential that every part of the surface be covered thoroughly, and no bare spots should be left anywhere.

Floors waterproofed by this method, intended to be used for traffic, should have the GF 141 Oilproofing coating protected with a topping of Portland cement and sand 1:2½, 1″ or preferably 2″ in thickness, laid immediately after the final finished coating of GF 141 Oilproofing. If this floor is intended for heavy traffic or trucking, it should be coated with GF 140 Grey Metallic Hardener, as detailed on page 58.

If to be used only for light traffic, it should be hardened and dust-proofed with GF 145 Crystalrox as detailed on page 60.



Franklin School, Sacramento, Calif. GF Crystalrox (GF 145) used for hardening floors. Architects, Hennings & Peterson, Sacramento.

GF CRYSTALROX (GF 145)

- *I Oilproofing and Hardening Cement Floors*
- *II Protecting Cork or Linoleum on Cement*
- *III Hardening Mosaic and Terrazzo Floors*
- *IV Protecting Masonry and Cement Surfaces from Weak Acids and Fumes*
- *V Stainproofing Limestone and Marble*
- *VI Painting Newly Plastered Walls*

A thoroughly dependable material for hardening and dustproofing old or new cement floors does more than cover the surface—it combines chemically with the cement, making the top surface of floor hard, impervious and wear-resistant. Such is the action of GF Crystalrox (GF 145), a chemical floor hardener applied as a liquid to new or old cement floors.

Tests prove that GF 145 increases the wear resistance of cement floors 30 to 50 per cent and renders them proof against oils, alkalies, dilute acids and water. All this is accomplished without changing the appearance of the floor—the surface is transformed into a crystal-hard, fine-textured floor.

By using GF 145 the voids in the surface are filled with hard, insoluble compounds. This completes the bond between the sand and cement and gives a dense, extremely hard-wearing surface.

While this surface will wear under severe and long continued traffic, it is a simple matter again to apply GF 145 after a few years and bring the floor back to the same good condition as when first hardened.

GF Crystalrox (GF 145) is in the form of crystals to be dissolved in water on the job. This method has been adopted for greater security and convenience in handling and storing, as in crystal form the material will keep indefinitely, without danger from frost, occupies less storage space and saves cost of barrels and freight.

In exceptional cases, cement floors may be found which are so porous that the GF 145 solution is absorbed into the lower part of the floor surface leaving the top surface unprotected. To meet such a condition it is necessary to use an extra coat to harden and dustproof the floor, but this occasion seldom arises especially if the following specifications are followed carefully in every detail.

On the other hand, some parts of the surfaces to be treated may be much denser than others and cannot absorb all the GF 145 contained in the two coats. This surplus will remain on the surface as a white patch, but will wear off quickly under traffic, or may be removed by scrubbing with hot water.

Shipping Data

Shipped in

Barrels, 325 lbs. net; drums, 240 lbs. net.
5 gal. drums 40 lbs. net; 1 gal. cans, 8 lbs. net.
Cartons, 14 lbs. net.
Cartons, 1 lb. net.

Preparation of GF 145 and Covering Capacities

GF 145 is applied in two coats made up as follows:

First Coat	Second Coat
2 lbs. GF 145 to 1½ gallons of Clear Water	2 lbs. GF 145 to 1 gallon of Clear Water
This covers 400 sq. ft. equal to 200 sq. ft. per lb. of GF 145	This covers 300 sq. ft. equal to 150 sq. ft. per lb. of GF 145

This forms a 17% solution over all.

Total covering capacity, 2 coats about 85 sq. ft. per lb.

Labor Cost

One man can apply 28 lbs. per day.

SPECIFICATIONS

For Applying GF Crystalrox (GF 145)

GENERAL

1—Material

GF Crystalrox (GF 145) is to be purchased direct from the manufacturers, The Genfire Steel Co., Youngstown, Ohio, or their authorized agents. It is to be brought to the building site in original packages and applied in accordance with the manufacturer's directions.

The GF 145 is dissolved in water for use as hereinafter specified.

2—Preparation of Material

GF 145 shall be dissolved in clear water and applied in two coats as follows:

First Coat—Two pounds of GF 145 to 1½ gallons of water.

Second Coat—Two pounds of GF 145 to 1 gallon of water.

3—Application

GF 145 may be applied with a brush or mop. The mop is the best to use, as it spreads the material more evenly, and with less labor for the workman.

Wash down with water to obtain the proper penetration, and as soon as the surface is dry (in about 10 minutes) the first coat of GF 145 shall be applied, followed about 12 hours later by the second coat.

If necessary a floor can be put into use after the application of the first coat of **GF** 145 solution and the second coat applied the next day, after brushing all dirt, etc. off the surface.

4—Caution

Solutions of **GF** 145 should be kept in earthenware or fibre pails. **GF** 145 has a strong corrosive tendency in direct contact with metal.

Don't let the material touch the eyes or open cuts.

To prevent evaporation, have the container tightly covered when not in use.

HARDENING CEMENT FLOORS

Paragraphs 1 to 4 are to be followed carefully, and

5—Preparation of Surface

New Floors—The floor must be completely set up and the treatment of **GF** 145 should not be made sooner than three weeks after finishing floor. Loose sand, dust, or other foreign matter must be brushed off to permit greatest penetration.

Old Floors—Remove all dirt, oil, grease, paint, etc.

UNDER LINOLEUM, CORK, CARPETS, ETC.

Paragraphs 1 to 4 are to be followed, and

6—Application

Cement floors intended to be covered with linoleum or cork, or other carpets shall receive 2 coats of **GF** 145, as before specified, to prevent dampness, condensation and subsequent damage to the covering.

HARDENING MOSAIC AND TERRAZZO FLOORS

The cement in mosaic and terrazzo floors soon disintegrates through the grinding in of dirt and dust and the chemical action of the strong soaps and alkalies used in cleaning the floors, so that the cement disappears, leaving the pieces of marble protruding, and they ultimately break out, leaving a pitted appearance.

Application of **GF** 145 will prevent such rotting away of the surface and also, to a considerable extent, prevent cracking of such floors. It can be used without changing the finished appearance and will also prevent staining and discoloration of the marble.

Paragraphs 1 to 4 are to be followed, and

7—Application

All mosaic and terrazzo floors, after rubbing and finishing the surfaces, are to be cleaned of all mortar, paint, dirt, etc., and to receive 2 coats of **GF** 145 dissolved in water as specified in par. 2.

PROTECTING FROM WEAK ACIDS AND FUMES

8—Application

GF Crystalrox (**GF** 145) will protect masonry and floors from weak solutions of organic acids and fumes.

It is applied in two coats with an interval of 24 hours between each, as specified in paragraphs 1 to 4.

GF 145 protects against the following:

Acetic Acid
Causticity of plastered surfaces
Creosote
Fruit Acids
Lactic Acid
Malic Acid
Molasses
Olive Oil
Sugar
Vinegar

STAINPROOFING LIMESTONE

Paragraphs 1 to 4 to be followed, and

9—Application

The surface of the stone shall be clean of all stains and foreign matter, and perfectly dry before application is commenced. **GF** 145 shall be applied in 2 coats of the proportions before specified, with a sponge, care being taken to get a thorough saturation.

Any excess material that is not absorbed at the end of five minutes shall be wiped off, as this material has not come in contact with the lime, and will be of no use as a protection to the stone.

PAINTING NEWLY PLASTERED WALLS

Paragraphs 1 to 4 to be followed, and

10—Application

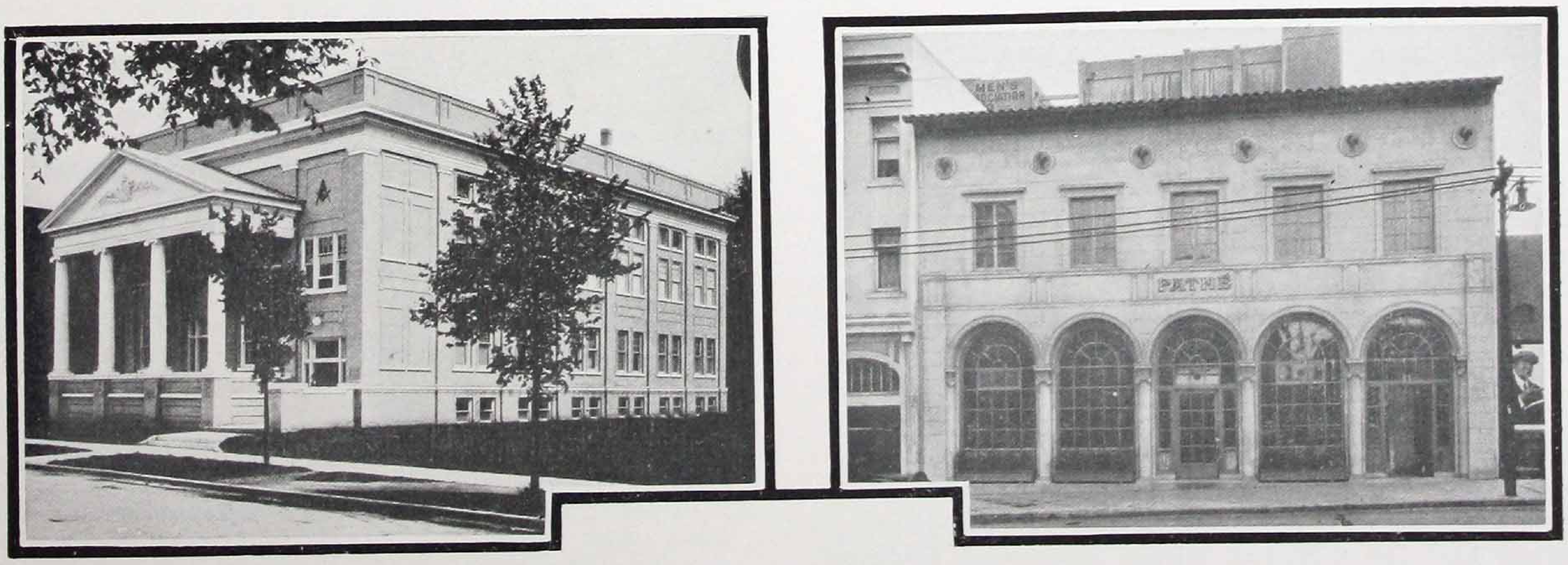
When it is desired to decorate new plastered walls immediately, a treatment of 2 lbs. of **GF** 145 and 1 gallon of water shall be liberally brushed on and allowed to dry thoroughly—this neutralizes the causticity of the surface, thereby permitting a paint coating immediately after the drying out of the treated surface, and is a sure preventive of saponification when linseed oil paint is used.

PAINTED SIGNS

11—Application

Treating concrete or brick wall surfaces, intended to receive painted signs with a coat of **GF** 145 consisting of 2 lbs. of **GF** 145 to 1 gallon of water will prevent saponification and subsequent cracking and peeling of the paint.

GF CRYSTALROX USED AS FLOOR HARDENER IN THESE BUILDINGS



GF FLOOR ENAMEL (GF 155)
GF CEMENT FLOOR BRUSHING LACQUER (GF 156)

I Painting Interior Cement and Composition Floors
II Preserving Mosaic and Terrazzo Floors

Cement floors, while advisable from a fireproofing standpoint, are sometimes objectionable because they become stained and unsightly, or may not harmonize with the general decorative scheme.

Linseed oil paint is not suitable for a decorative coating for a cement floor because the free lime liberated by the cement in setting combines with the oil to form a water soluble soap. When the surface is washed or cleaned, this soap washes out taking the pigments with it.

Graphite, lampblack, ochre and all coloring pigments of a similar nature hasten the corrosion of metal, but chromate pigments will prevent corrosion as evidenced by the results of tests made by Cushman, Gardner and other recognized paint experts.

GF 155 Cement Floor Enamel has been developed upon proper scientific consideration of the above facts. The vehicle is compounded of certain oils, so made that it will hold pigments well in suspension, and it is immune from attack by alkalies or weak acid solutions.

The pigments are very finely ground and so combined with the vehicle that they both penetrate the pores of the surface sufficiently to obtain a good bond.

A cement floor laid upon ground or fill should never be painted if it shows any signs of dampness coming up from below. Such a floor should first be tested by laying a rubber mat upon it for 3 or 4 days. If the surface under the mat shows dampness, that is a sign that it is not suitable for painting.

Water, in penetrating a surface, exerts a water pressure which will be sufficient to force any paint film up off the surface.

Even if this test does not show signs of dampness a floor laid upon earth or fill should always receive first a priming coat of GF155 Primer to act as a bond for the paint.

A new cement floor must be given plenty of time—4 to 6 weeks or even longer, if necessary—to dry out thoroughly, before being painted. A priming coat of GF 155 Primer should always be used.

Any cement floor intended to be painted must be perfectly clean and dry. Never use water, soap, lye or alkalies to clean a cement floor. If washing is necessary, it should be done by scrubbing with turpentine, not water.

GF 155 Transparent applied to Mosaic or Terrazzo floors will protect them and enhance the colors and appearance of the tile and marble.

GF 155 Transparent applied to colored cement floors (GF 12 Colored or dry pigments) will give a bright glossy finish and intensify and help uniform the depth of the color.

GF 155 Transparent is the priming coat for GF 250 Colored.

For Basement floors, or in cases where the floor must be put in service soon after painting, we make this paint in a special form which is called GF 156 Cement Floor Brushing Lacquer. When GF 156 is used, no priming coat is required, and a floor painted with this can be used 12 hours later.

NOTE: Cement floors of porches and tennis courts should be painted with GF 101 (see page 55).

GF 155, and GF 156 are made in Stone Grey.

Covering Capacity
300 sq. ft. per gal. 1 coat. 200 sq. ft. per gal. 2 coats.

Labor Cost
One man can apply 10 gallons per day.

Shipped in
1 gal. cans
5 gal. drums
30 gal. half barrels
55-60 gal. agitator barrels.

Shipping Weight
14 lbs. per gallon.

Net weight
11½ lbs. per gallon.

SPECIFICATIONS

For Applying GF Floor Enamel (GF 155)
and GF Brushing Lacquer (GF 156)

1—Material.

GF Floor Enamel (GF 155) or GF Brushing Lacquer (GF 156) as manufactured by the Genfire Steel Company, Youngstown, O. shall be purchased direct from them or their authorized agents and brought to the building site in original sealed packages and shall not be adulterated or thinned except as hereafter specified.

2—Preparation of material for application.

Remove top of package and stir and mix thoroughly.

If thinner is required, a very small quantity of pure turpentine may be used for GF 155 Cement Floor Paint, or GF 156 Thinners for GF 156 Lacquer.

3—Preparation of surfaces.

The surfaces should be entirely cleaned of dirt, oil, grease, plaster or loose cement. The floor shall be perfectly dry thruout its entire thickness.

Any previous coating shall be entirely removed with a blow torch or varnish remover, using wire brushes to clean off scale, mortar or paint.

Water, soap, lye or alkalies must never be used, for washing use turpentine and wire brushes.

4—Application.

First, apply a good coat of GF 155 Primer well brushed in, and allow 24 hours to dry.

Second, apply the first coat of GF 155 Floor Enamel brushed evenly into the surface.

Third, apply the second coat of GF 155 Floor Enamel, 48 hours after first coat.

The specifications for application of GF 156 Cement Floor Brushing Lacquer are the same as above for GF 155 Cement Floor Enamel, except that no priming coat is necessary.

The second coat of GF 156 can be applied 4 to 6 hours after the first coat and the floor used 12 hours after the second coat has been applied. NEVER paint a cement floor if the mat test shows signs of dampness. For basement floors it is always preferable to use GF 156 Cement Floor Brushing Lacquer.

GF WOOD FLOOR PRESERVATIVE (GF 160)

(A RESINOUS BRUSH COATING)

I *Preserving Wood Floors*
II *Preserving Cork, Magnesite, Linoleum and Composition Floors*
III *Preserving Dance, Skating and Gymnasium Floors*
IV *Protecting Posts, Trusses and Exterior Trim*

The reserves or saps of all woods, used in any kind of building construction, rot away, dry out and are destroyed. These saps are the natural glues which bind the fibers together and impart strength and hardness to the wood.

When the sap disappears the fibers of the wood separate causing splinters, peeling away of the surface, and disintegration which gradually extends throughout the thickness of the wood.

The destruction of the sap is greatly hastened by exposure to the air, to alternating hot and cold or wet and dry conditions, to the penetration of water, soaps, alkalies, oils, and chemicals, and also by the attacks of insects, parasites, and fungi which propagate freely in damp and warm surroundings.

To increase the durability of any kind of wood, it is necessary to supply that which nature has omitted by putting into the pores of the wood a compound that will take the place of the sap that may be lacking, prevent the decay of that which already exists and protect it from the attacks of the destructive agencies mentioned.

A product for this purpose should, preferably, be of the same nature as the saps themselves so that it can enter into combination with and become an integral part of that which it is to protect and at the same time be immune from the attacks of all agencies that destroy sap.

Paste fillers when forced into the pores of the wood remain there as an inert fill, in no way entering into combination with or protecting the sap. They are effective only so long as they are protected by the shellac, varnish or paint coating applied to the surface.

Linseed oil, or linseed oil and hot paraffin treatments serve only temporarily to cover and protect the surface, as being of an entirely different composition, these oils in no way combine with the sap. The linseed oil molecules are comparatively large so that the oil is unable to penetrate far into the pores. It therefore remains mostly upon the surface where it soon wears away under traffic or volatilizes under the action of the elements. Linseed oil is also dissolved and washed away under the action of soaps, alkalies or water.

Paint and varnish remain mostly upon the surface having only slight penetrative powers or bonding affinity for the sap so that they soon wear off or the oils volatilize.

GF Wood Floor Preservative (GF 160)

GF Wood Floor Preservative (GF 160) is composed of a mixture of China Wood, Perilla and Sunflower Oils, holding certain natural Congo gums in solution, the latter giving toughness and resiliency to the mixture.

GF 160 is of practically the same composition as the saps of all woods used for building construction.

The small molecules of these oils enter into the minutest pores of the wood, where they effect a chemical union with the saps and fill those parts of the wood which contain little, if any resin, thus turning even a soft wood into a hard wood.

GF 160 does not evaporate, on the contrary it absorbs oxygen, thereby increasing in density and weight after penetration into the wood, so that it forms a permanent, natural, resinous fill for the pores.

GF 160 is transparent but naturally darkens the white bands of wood fibre between the rings of sap, three or four shades.

GF 160 is intended for hard or soft wood floors, sash, trim, and wood finish generally either under cover or exposed.

GF 160 dries with an eggshell gloss finish which is sufficient for many places such as stores, showrooms, public buildings, schools, etc.

If a high gloss finish is desired wood treated with GF 160 can be varnished with any good wood varnish, as the China Wood Oil base of all high grade varnishes bonds perfectly to it. The GF 160 gives depth to the varnish coating in much the same way as the quicksilver on the back of a mirror gives depth to the glass, so that one coat of varnish is equivalent, in appearance, to two or three coats on an untreated surface.

GF 160 affords an excellent base on which to apply a polish as it keeps the polish on the surface. For dance hall or skating rink floors it gives a hard resilient surface that will hold the wax on top where it is required.

When **GF 160** is used, a paste filler is not required as the **GF 160** acts as both filler and finish.

For all except the very softest woods, one coat of GF 160, liberally brushed on with a long-handled brush and allowed to soak into the pores, is sufficient.

The total cost of **GF 160** applied is slightly less than that of a linseed oil and hot paraffin treatment, while it is permanent, does not wear off and polishes under traffic.

The surface to which **GF 160** is applied must be perfectly clean and dry to afford proper penetration. It can be applied to old floors or woodwork, if the surfaces are cleaned of all dirt, grease, and any oil or paint that may have been previously applied.

Any cracks or open joints in old work should first be filled with GF 250 Brown Elastic Cement.

When treating new floors, it is very advisable to protect the underside and edges of the boards against shrinkage and dry rot by dipping the boards before they are laid in a shallow pan containing GF 160.

After laying, the exposed surfaces of the boards should receive one coat of **GF 160** as above detailed.

Protecting Posts, Trusses, Structural Timbers and Exterior Trim from Cracking, Dry Rot, Etc.

Cracking and splintering of structural members, trim, etc., exposed to the atmosphere are caused by the drying out and rotting away of the natural saps that cement the wood fibres together. These losses can be prevented or stopped by treating with **GF 160** which fills the pores and combines with the saps to form a tough, elastic fill that is unaffected by dampness or atmospheric changes.

All structural timbers and trim should be perfectly dry and cleaned of all dirt, dust, paint or mortar and then given one coat of GF Wood Preservative (**GF 160**) liberally brushed into the pores.

Composition, Linoleum and Cork-Tile Floors

The wearing qualities and appearance of linoleum composition and cork-tile carpets and floors will be considerably increased and improved by a treatment of GF 160 Wood Floor Preservative, as it will assist in retaining the freshness of the colors, prevent the grinding in of dust and dirt, and also preserve the surface and constituents of the composition from the destructive effects of oil, grease, water, alkalies, etc.

Skating Rinks, Dance and Gymnasium Floors

The floors of skating rinks and gymnasiums are rendered wearproof and dustless by the application of one coat of **GF 160**.

On dance floors a prior application of **GF 160** will fill the pores and give a hard, resilient surface for the application of the wax coating.

Magnesite Stucco

Leaky magnestie stucco walls can be rendered dampproof by pointing up all cracks with **GF 250** Colored and then thoroughly coating with either **GF** 100 Transparent Waterproofing or **GF 160** Wood Floor Preservative.

Owing to the great porosity of magnesite stucco more than two coats are generally required to render the surface non-absorbent.

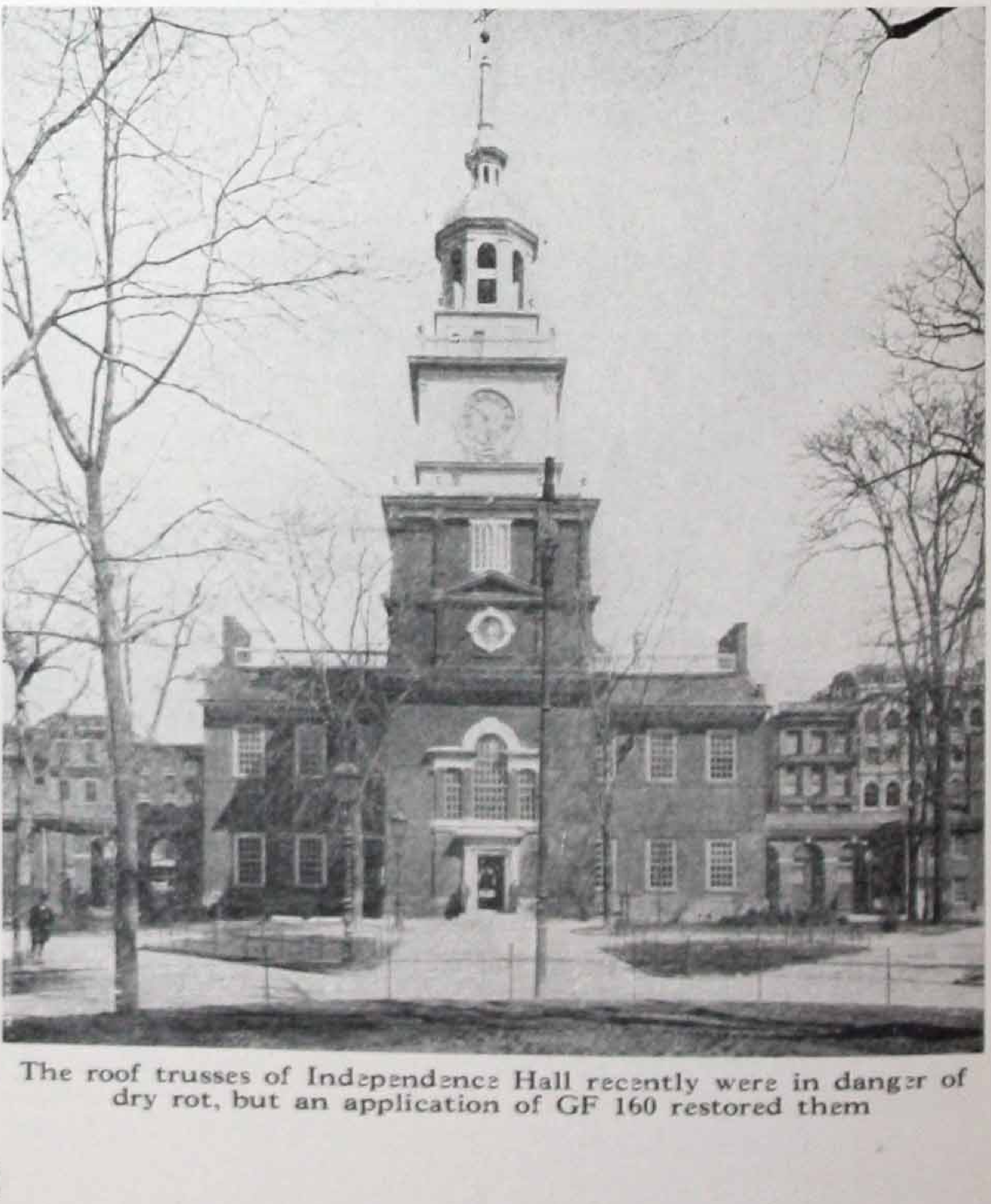
Shipping Data

Shipped in
- 1-gallon cans
- 5-gallon drums
- 30-gallon half-drums
- 55-gallon drums

Shipping Weight
- 9 lbs. per gallon
- Net weight, 7½ lbs. per gallon

Covering capacity
- 400 to 500 sq. ft. per gallon

Labor Cost
- One man can apply 15 gallons per day.



The roof trusses of Independence Hall recently were in danger of dry rot, but an application of GF 160 restored them

GF DAMPPROOF COATING (GF 200)

A BITUMEN PAINT

I *Dampproofing Interiors of Exposed Walls Above Grade*

II *Insulating Exposed Walls*

III *Protecting Wood Trim*

Dampproofing Coatings are applied to walls which are later plaster finished for two reasons. First—to maintain sanitary conditions which is not possible when dampness gets through into the atmosphere of the room or is constantly present in the walls. Second—to prevent streaking and discoloration due to moisture seeping through from the outside.

The application of this dampproofing material directly upon the surface to be plastered makes necessary a compound with a strong "tack" to aid in bonding the plaster. Dampproofing to be effective must expand and contract with the wall without cracking. Further than this, permanent dampproofing qualities are necessary, for a job once finished cannot be repaired or renewed except at great cost.

GF Dampproof Coating (GF 200) is a high grade bitumen paint that will fully meet all the requirements of a paint for this purpose and will, in addition, dry with a "tacky" surface, remaining so for a period of three to four weeks, so that plaster can be applied directly to it within that period, thereby eliminating the necessity for wood furring. Where wood lath is used, a coat of GF 200 applied to the lath before plastering will prevent the lath giving a streaked appearance to the plaster after it has dried out.

The following is the analysis of GF 200

Gravity at 60° Fahr	20°
Specific Gravity at 68° Fahr	0.957
Non-volatile components consisting of Mexican bitumen (Gilsonite 20%)	60%
China Wood Oil and volatile vehicle consisting of a Distillate of bitumen base	40%
Coal Tar or Pitch	None

GF 200 is intended for use only above grade and should not be used for dampproofing substructures.

As an insulator to maintain uniform temperature and dry air in a building, GF 200 is applied to the rough wall before the furring is put up. This keeps dry at all times the air space formed by the furring, affording the best possible insulation against the passage of heat, cold and dampness.

GF 200 prevents efflorescence and staining by barring effectively the moisture which combines with salts and alkali in mortar to cause these forms of discoloration. Where wood trim is erected over green masonry or walls which may become damp occasionally, a coating of GF 200 on the back of the trim will prevent warping, cracking and staining.

GF 200, or similar paints, is not a plaster bond. The bonding of plaster is obtained by capillary attraction and by the keying of the plaster into the pores and irregularities of the surface to which it is applied. Interposing a waterproof film prevents capillary action, and diminishes the pores and irregularities of the surface. For the latter reason GF 200 is specially prepared so that it dries "tacky" to enable it to stick to the plaster.

GF 200, therefore, should never be used for ceilings. Neither should it be applied to concrete or cement wall surfaces, unless they are first well chipped or roughened to afford a mechanical bond for the plaster.

GF 200 should never be used on any surface intended to receive a Portland cement plaster finish. In such cases GF Waterproofing Paste (GF 10) should be used in the Portland cement coating.

A dampproof paint should never be used on the inside face of walls below grade. The film of paint has not sufficient tensile strength to resist water pressure and will be forced off the wall. In such cases the walls should be waterproofed with GF Waterproofing Paste (GF 10), used either integrally in the concrete, in the form of a Portland cement plaster coat, or in the first or scratch coat of mortar.

GF 200 is applied cold with a brush or a spray just as shipped.

Covering Capacity

This varies with the porosity of the brick or tile, and is approximately—

First Coat	75 sq. ft. per gallon
Second Coat	100 sq. ft. per gallon
For 2 Coats	50 sq. ft. per gallon

Labor Cost

One man can apply 30 gallons per day.

GF 200 can be applied effectively and economically by means of a spray.

Shipping Data

Shipped in
1-gallon cans
5-gallon drums
30-gallon half-drums
55-gallon drums

Shipping Weight
10 pounds per gallon

Net Weight
8½ lbs. per gallon

SPECIFICATIONS

For Applying GF Dampproofing Coating (GF 200)

GENERAL

1—Material

GF Dampproofing Coating (GF 200), as manufactured by The Genfire Steel Co., Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized agents, and delivered on the building site in original packages. It must be used without the addition of any thinning agents or any adulteration.

2—Pointing

All large holes must be pointed up to provide a smooth surface.

3—Application

Two thorough covering coats of GF 200 are to be applied to (name surface) twenty-four hours being allowed between coats. These coats must be continuous and perfect in every respect.

The coating is to be carried into all chases and reveals and well brushed into all recesses and joints.

4—Intersecting Angles

The intersecting angles of all walls and floor slabs coming in contact with weather exposed walls shall be carefully coated, the coating being carried out from the wall not less than 18" on all such intersecting walls or floor slabs.

5—Plastering

Lime plaster may be applied over surfaces covered with GF Dampproofing Coating (GF 200) within an interval of from one to thirty days.

TRIM IN CONTACT WITH MASONRY OR PLASTERED SURFACES

6—Application

The back of all trim shall receive a heavy coat of GF 200 before it is erected. This coating may be applied either at the plant where the trim is manufactured or on the job immediately before it is erected.

Sinclair Building, Tulsa, Okla. GF Dampproof Coating (GF 200) used.

Springfield (Ill.), High School. GF 16 and GF 200 used. Helme and Helme, Architects, Springfield, Ill. Barke Construction Co., Contractors.

GF STAINPROOF COATING (GF 220)

A BITUMEN PAINT APPLIED COLD

I Stainproofing Stone

II Protecting Brick, Cement, Plaster, Wood or Metal Surfaces From Acids, Smoke or Fumes

Whenever limestone, marble or other light colored and expensive building stone is used it becomes necessary, from the standpoint of economy and beauty, to protect them against unsightly stains. These stains are caused by the absorption of salts and other coloring matter from the backing walls which will invariably work through to the surface unless the stones are carefully stainproofed.

That architects realize the danger from this source is evidenced by the fact that they sometimes specify a non-staining cement for the setting of such stone. This is good as far as it goes, but it has been demonstrated time and again that to protect stone from the cement mortar stains used in laying the backing, some means must be used to repel not only dampness but also acids and alkalies.

GF Stainproof Stone Backing (GF 220) is a bitumen, refined by a process which extracts all the light oils and formed into a paint consisting of:

Non-volatile bitumen	60%
Volatile vehicle	40%
Coal tar or pitch	None

GF 220 is made of the same bitumen and is of a similar nature to GF 200.

GF 220 is specially treated so that while it adheres tenaciously to the stone, each coat becomes entirely hard in about 20 minutes after application. One hour after being painted the stone can be placed in position with the assurance that the built-in portions are entirely enveloped in an enduring water and alkali-proof, elastic film.

Note: To preserve the life and beauty of cut stone it is just as essential to protect the exposed face as the unexposed parts.

Smoke and gases in the air, or dust and dirt carried into the surface by rain-water cause permanent discoloration, while saturation with water, which subsequently freezes, causes cracks and spalls.

GF Crystalrox (GF 145) will preserve the life and appearance of any kind of marble or cut stone, without changing its physical appearance.

Covering Capacity

First coat	75 to 100 sq. ft. per gallon
Second coat	125 to 150 sq. ft. per gallon
Two coats	50 to 65 sq. ft. per gallon

Labor Cost

One man can apply 5 gallons per day.

GF 220 can be applied economically and effectively by means of a spray.

Shipping Data

Shipped in
1-gallon cans
5-gallon drums
30-gallon half-drums
55-gallon drums

Shipping Weight
10 pounds per gallon
Net Weight
8½ pounds per gallon

SPECIFICATIONS

For Applying GF Stainproof Coating (GF 220)

GENERAL

1—Materials

GF Stainproof Stone Backing (GF 220), as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased direct from the manufacturers or their authorized agents, and delivered to the building site in original packages. This material must be applied without addition or adulteration.

2—Preparing Surfaces

The surfaces of the stone are to be cleaned and dried thoroughly before receiving the coating.

3—Application

All unexposed surfaces of the stone to be thoroughly covered to within 1" of the edge of the face with two coats of GF 220, twenty-four hours to elapse between coats.

The coating thus applied must be thoroughly dry before the stones are handled.

4—Coating Stone after Erection

After the stone has been set in place, and before the backing is carried up, the unexposed surfaces and joints shall be given a thorough covering coat of GF 220.

5—Protection Against Acids, etc.

To protect various surfaces against the following acids, etc., two coats of GF 220 should be applied, taking care that the film completely covers the entire surface.

Acetic Acid
Cyanides
Garbage
Mineral Acids and Dilutes
Sewage
Sulphuric Acid
Vinegar

GF MASTIC CEMENT (GF 250)

- *I Waterproofing Against Water Pressure From Inside Only*
  - *1. Trowel Coating Inside*
- *II Dampproofing Against Seepage Below Grade*
  - *1. Trowel Coating Outside*
- *III Dampproofing Floors Below Grade*
  - *1. Trowel Coating*
- *IV Waterproofing Brick, Stone, Stucco, Concrete Walls*
  - *1. Elastic Coating*
- *V Exposed Walls Above Grade*
  - *1. Trowel Coating*
- *VI Caulking Windows*
  - *1. Oakum & Elastic Cement*
- *VII Expansion Joints*
  - *1. Cold Elastic Fill*
- *VIII Filling Cracks and Tuck Pointing*
  - *1. Elastic Fill (Colored)*
- *IX Roofings and Repairing Leaky Roofs*
  - *1. Brush Coating*
  - *2. Trowel Coating*
- *X Boiler Insulation*

There are a great many uses for waterproof cement, such as pointing between copings or flashings and walls, for joints between vault lights, embedding hip rolls and ridgings, pointing up valleys where close fits are not possible, and around leaky chimneys—in fact, wherever joints or cracks in masonry must be protected against water penetration.

GF 250 is a plastic waterproof cement made on a bitumen base, containing asbestos fibre and vulcanized china wood oil, which can easily be troweled onto a horizontal or vertical surface where it adheres permanently and sets into a firm, durable coating. It is so constituted that there is no danger of cracking even in zero weather or of running under severe heat. As asbestos fibre is used as a binder, GF 250 is particularly valuable as a filler for joints and as a covering for concrete roofs.

(Note—GF 251 is used in combination with oakum for waterproofing joints around door casings, window frames, skylights and dormers. It is similar to GF 250 but of a stiffer consistency so that it can be used by hand or gun for window caulking, tuck pointing, etc.)

GF 250 is used over shingles, tin, canvas, ready roofing, slate, tile or concrete, and adheres to all. It has the consistency of putty, is easily applied with a trowel and sets into a strong, watertight joint or coating, which will expand or contract readily with the material to which it is applied.

GF 250 never sets hard so when used on roofs dirt and dust may settle to form a film over the surface. Where for appearance sake this is undesirable, slag, pebbles, crushed brick, marble, granite or colored sand may be rolled into the finished surface to give an artistic treatment.

GF 250, black or colored, is such a convenient, easily applied, general utility product, that a barrel or can of it should be kept on hand in every plant, factory, office building, farm or home.

Kept covered, it does not deteriorate and in cases of small emergencies, it is an ever ready means of stopping a leak. During a rainstorm, leaks in a roof are very apparent and can be stopped at that time with a little GF 250 troweled on, as it will adhere to a wet surface.

If troughs, tanks, containers, barrels, develop cracks or leaks, GF 250 will stop them.

A piece of linen wrapped around electric wires and coated with GF 250 Black will insulate them perfectly.

Garages and barns develop cracks around windows and doors becoming cold and draughty. GF 250 will fill these cracks permanently.

Its greatest advantages are that it is a permanent waterproofing, always ready for use, it is cheap and does not require skilled labor to apply.

Colors

It is furnished in black, brown, red, gray, green and buff.

Priming

On all surfaces except metal a coating of GF 250 Primer must be first applied for GF 250 black, or GF 155 Transparent for GF 250 colored.

Covering Capacities

GF 250 primer, 50 sq. ft. per gallon.
GF 250 black and colored, 20 sq. ft. per gallon.
Flat or vertical surfaces, 20 sq. ft. per gallon, or 2 sq. ft. per lb.
½" expansion joints, 3 sq. ft. per gallon.
Pointing up, 400 lineal feet of cracks per gallon.
Caulking windows, 8 ordinary sized windows per

Labor Cost

1 man can apply 30 gals. GF 250 Primer per day.
1 man can apply 20 gals. GF 250 on walls per day.
1 man can apply 100 gals. GF 250 on flat surface per day.
1 man can caulk 10 ordinary windows per day.

Shipping Data

GF 250 PRIMER
Shipped in 60 gal. drums
40 gal. half-drums
5 gal. drums
1 gal. cans
Shipping weight 10 lbs. per gal.
Net weight 8 lbs. per gal.
GF 250 BLACK
Shipped in 55 gal. drums
30 gal. half drums
5 gal. drums
1 gal. cans
Shipping weight 12 lbs. per gal.
Net weight 10 lbs. per gal.
GF 250 COLORED
Shipped in 55 gal. barrels
30 gal. half-barrels
5 gal. drums
1 gal. cans
Shipping weight 22 lbs. per gal.
Net weight 20 lbs. per gal.

SPECIFICATIONS

For Applying GF Mastic Cement GF 250

General

1—Material

GF Mastic Cement (GF 250), as manufactured by The Genfire Steel Co., Youngstown, Ohio, must be purchased direct from the manufacturers or their authorized agents. The material delivered on the building site in original packages, and applied according to the manufacturer's directions, without addition or adulteration.

2—Preparation of Surface

The surface is to be thoroughly wire brushed so as to remove all loose particles, scale, mortar, etc., and leave the surface in a firm and solid condition. All large holes or cracks are to be pointed with cement mortar before the coating is applied.

3—Application of Primer

Before applying GF 250, the entire surface is to be given a liberal brush coat of GF 250 Primer or GF 155 Transparent brushed well into the pores, being careful to cover thoroughly all voids and cracks.

DAMPPROOFING BELOW GRADE

Paragraphs 1, 2 and 3 are to be followed carefully, and

4—

As soon as built or forms removed, the exterior faces of all earth-exposed walls shall receive a trowel coating of GF 250 Black. The back filling may then be done immediately, care being taken not to scrape off the GF 250 coating.

5—Dampcourse

The tops of all footings, before foundation walls are built, and the tops of all foundation walls, before starting the brick or stonework, shall be covered with a trowel coating of GF 250 Black.

DAMPPROOFING PLASTERED WALLS

Paragraphs 1, 2 and 3 are to be followed, and

6—

The inside faces of all weather-exposed walls above grade, specified to be plastered, shall have a trowel coating of GF 250 Black. This coating to be carried into all reveals, chases, and recesses, out on all ceiling arches, for a distance of 6″ and on both sides of abutting walls, for a distance of 18″.

WATERPROOFING BRICK OR CONCRETE WALLS

Paragraphs 1, 2 and 3 are to be followed carefully, and

7—Application

A thorough coating of GF 250 is to be troweled over the entire surface. Great care must be taken that the coating is thoroughly troweled in around all window frames to insure a tight joint around lintels and sills. The coating thus applied should be not less than $\frac{1}{16}$″ thick at any point.

WATERPROOFING THE BACKS OF PARAPET WALLS

Paragraphs 1, 2 and 3 are to be followed carefully, and

8—Application

A thorough coating of GF 250 is to be troweled over the back of parapet walls, great care being taken to see that the joint between cap flashing and the first course of brick above is very carefully filled. Where there is a concrete parapet, this Mastic Cement should be brought down well under the copper flashing so as to fill thoroughly this joint.

This coating should be carried up through and under the coping, whether it be of tile, limestone or concrete.

CAULKING AROUND WINDOW FRAMES

Paragraphs 1, 2 and 3 to be followed, and

9—Application

Remove weather strips, caulk joint between window frames and masonry with oakum or mineral wool, tightly packed in with a hammer and caulking chisel, to within $\frac{1}{4}$″ of the face. Then cover with GF 250 Colored or GF 251, pressed on with the point of a trowel, and replace weather strips.

EXPANSION JOINTS IN FLOORS, WALLS, VIADUCTS, SIDEWALKS AND VAULT LIGHTS

Paragraphs 1, 2 and 3 to be followed, and

10—Application

All expansion joints are to be smooth and clean.

Apply a brush coating of GF 250 Primer, if GF 250 Black is to be used, or of GF 155 Transparent if GF 250 Colored is to be used.

Then apply a coating of GF 250 Black or Colored Elastic Cement, troweled on smoothly to a thickness of $\frac{1}{2}$″.

Where expansion joints have been previously formed and left for filling later, they are to be scraped and wire brushed perfectly clean.

Apply a brush coating of GF 250 Primer when using GF 250 or GF 155 Transparent when using GF 250 Colored, and then fill the joint with GF 250 solidly pressed into the joint by means of a small pointing trowel, flush with the surface. Smooth off the top with a trowel and dust over with a sprinkling of dry cement.

(Note—GF 17 Bitumen (see page 44) is also used as an expansion joint filler as it is waterproof, extremely ductile and is unaffected by temperature changes.

GF 17 is suitable only for use in filling expansion joints that have been previously formed as it has to be melted and poured in place while hot.)

TUCK POINTING OF CRACKS AND OPEN JOINTS

Paragraphs 1, 2 and 3 are to be followed carefully, and

11—Application

Cracks and open joints in any kind of masonry construction or stucco to be raked out clean and dry.

If very wide and deep, caulk with oakum or mineral wool, tightly driven in with a hammer and caulking chisel to within $\frac{1}{4}$″ of the face.

Fill the joint flush with the surface with either

GF 250 Black or Colored, put in with the point of a trowel, or

GF 251 Window Caulking Compound put in by hand, or if limestone, marble or light colored stone, with GF 252 Rubber Caulking Compound put in by hand.

Smooth off the surface of the filling with the flat of a trowel so that it is flush with the surface, and dust a little dry cement on top.

WATERPROOFING FLAT OR PITCHED CONCRETE OR WOOD ROOFS

Paragraphs 1, 2 and 3 are to be followed, and

12—Application

A thorough coating of GF 250 is to be troweled over the entire surface of the roof not less than 1-16″ thick. This GF 250 is to be extended up all bulkhead and chimney walls to a height of 8″ and up the parapet walls to the height of the copings.

When the roof construction is of wood, the roof is first covered with a layer of GF 18 Felt with a lap of 1″ at edges nailed with roofing tins and nails 12″ apart along edges and 24″ apart in center of each sheet, after which apply a coating of GF 250 Primer before troweling on the GF 250.

13—Gravel or Slag

Either regular roofing slag or small roofing gravel may be rolled into the surface of this coating for protection and texture effect. Not less than 200 pounds of slag or 250 pounds of gravel per 100 square feet are to be used. The gravel or slag must be perfectly dry so, if necessary, heat it to obtain this result.

REPAIRING LEAKS IN OLD ROOFS

14—Application

Sweep surface free of dust, dirt, etc., cover any roof holes or cracks with a piece of tin or tar paper and cover with a coating of GF 250 troweled on. Cracks and holes in gutters, flashings, around skylights, etc., to be filled with GF 250.

SETTING CAP FLASHING

General—Paragraphs 1, 2 and 3 to be followed, and

15—Application

Before the cap flashing is set into the brickwork, a coating of GF 250 shall be troweled over the entire surface of the brick. After the cap flashing is set, another covering coat shall be troweled over the top of the flashing so as to give a thoroughly filled joint before the cement mortar is applied for setting the upper course of brick.

BOILER INSULATION

Note: The radiation of heat through boiler settings amounts to 25% to 30% of the fuel consumption and this loss can be avoided by the use of GF 250.

Paragraphs 1, 2 and 3 to be followed, and

16—Application

Apply a thick trowel coating of GF 250 Black to the top, sides and front, troweled on to a smooth, even surface.

GF WINDOW CAULKING COMPOUND (GF 251)

(FORMERLY GF 270)

Dampness and wet spots on the inside faces of walls above grade, exposed to the weather, are often caused by rain water driving in through the joints between walls and window and door frames.

If window and door frames are of wood, the wood swells when the water in the wet masonry comes in contact with it and afterwards dries out and shrinks. This shrinkage of the frames leaves permanently open joints that cannot entirely be kept closed by weather stripping. Water driven in thru these open joints is absorbed by the walls and may appear on the inner faces, sometimes several feet from the joint through which it entered.

The best way to prevent this is to fill the open joints with an elastic material that is waterproof and will keep these joints permanently filled under all weather and temperature changes.

GF 251 Window Caulking Compound is a product specially manufactured for this purpose. It is composed of Vulcanized China Wood Oil and coloring pigments, with a binder of asbestos fibre, and is of such a consistency that it can be used either by hand or with a gun for window caulking, tuck pointing and filling expansion joints. It will not dry out, crack in winter, or run in summer.

Colors

GF 251 is made in light and dark grey.

GF 251 is supplied in proper consistency for either hand, knife or gun application.

If found too heavy for gun application it may be thinned by adding a very small quantity of boiled linseed oil.

Shipping Data

Shipped in
5 gallons drums
1 gallon cans

Shipping weight	17 lbs. per gallon
Net weight	15 lbs. per gallon

SPECIFICATIONS

For Using GF 251

1—Caulking Window and Door Frames

Remove weather strips, caulk the joint between the frames and walls with oakum or mineral wool, tightly packed in with hammer and caulking chisel to about ¼″ of the face.

Cover with GF 251, pressed in tightly by hand or with a gun and troweled on top flush with the face.

TUCK POINTING CRACKS AND OPEN JOINTS

2—Application

Cracks and open joints in any kind of masonry construction or stucco to be raked out clean and dry. If very wide, caulk with oakum or mineral wool tightly driven in with hammer and caulking chisel to within ¼″ of the face. Fill the joint flush with the surface with GF 251 Caulking Compound or if limestone, marble or light colored stone, with GF 252 Rubber Caulking Compound put in by hand.

Smooth off the surface of the filling with the flat of a trowel flush with the surface, and dust a little dry cement on top.

GF RUBBER CAULKING COMPOUND (GF 252)

Formerly GF 270

FOR MARBLE, LIMESTONE AND OTHER LIGHT-COLORED POROUS STONE

Because Marble, Limestone and similar light-colored, porous stone are very easily stained, a special caulking compound, GF 252 Rubber Caulking Compound, is used. This product has the same general characteristics as GF 251, with the added feature that it will not stain the stone to which it is applied.

Shipping Data

Shipped in
- 5 gallon drums
- 1 gallon cans

Shipping weight	22 lbs. per gallon
Net weight	20 lbs. per gallon

Colors
GF 252 is made in light grey.

SPECIFICATIONS
For Using GF 252

The application of GF 252 Rubber Caulking Compound is exactly the same as GF 251.

GF 252 is supplied in proper consistancy for either hand or knife application. Owing to the nature of its constituents it cannot be supplied or thinned to the proper consistency for gun application.

GF BRUSH COATING (GF 253)

I Re-Surfacing Old and Leaky Roofs
II Temporary Roofs

GF Brush Coating (GF 253) has the same general constituents as GF 250 Black, but it is sufficiently liquid to be applied with a brush. It is particularly adaptable for re-surfacing any kind of old and leaky roofs or for temporary roofs.

Covering Capacity
About 100 sq. ft. per gallon

Shipping Data

Shipped in
- 55 gallon drums
- 30 gallon half-drums
- 5 gallon drums
- 1 gallon cans

Shipping Weight
10 lbs. per gallon
Net Weight 8 lbs. per gallon

SPECIFICATIONS
For Using GF 253

1—Application

Sweep surface free of dust, dirt, etc., cover holes or cracks with pieces of tin or tar paper, then cover with a coating of GF 253. If the roof is covered with slag or gravel this should be brushed into a pile and the roof coated with GF 253. The slag or gravel should then be replaced.

If desired, the brush coating may be applied right over the slag, or gravel, but considerably more of the material will be needed, and care must be taken to see that it is thoroughly brushed in.

GF 250 being applied to Roof of Ft. McHenry Hospital, Baltimore, Md.

GF STEEL COATING (GF 300)

I Protecting Structural Steel From Acids, Alkalies, Rust and Electrolysis

The composition of a coating for steel must be such as to overcome the several disintegrating influences to be encountered.

The first of these is the action of the alkali in cement which comes in contact with the steel. Steel Coating must be compounded especially to retain its waterproofing value, for where cement reaches ordinary oil paints, it soon destroys the oil, leaving only a cracked and ineffective pigment adhering to the metal.

The second influence is that of electrolysis, caused by stray electric currents finding their way to the steel through cracks in the coating containing moisture. Unless the film remains intact over the whole surface, expanding and contracting with the steel without cracking, it cannot be considered a dependable coating.

A linseed oil film, unless the oil is polymerized, will in a short time develop many microscopic holes formed by the dissipation of the foots and impurities naturally present in the oil. Water will easily penetrate through these holes. China wood oil contains no such impurities and the resultant film is absolutely and permanently waterproof.

Graphite, lampblack, ochre and all coloring pigments of a similar nature will greatly hasten corrosion of metal, while chromate pigments will prevent corrosion as evidenced by the results of tests by Cushman, Gardner and other recognized paint experts.

GF 300 Steel Coating is designed especially for structural steel. When brushed thoroughly over the entire surface it forms a tough, adhesive film impervious to water, acids and alkali, and insulates the steel from electricity.

Its expansion has been made exactly the same as that of steel, eliminating any danger of cracking or scaling upon the expansion and contraction of the metal.

The constituent materials of GF 300 are selected to insure adhesion and are strongly rust preventive, combining to form a heavy, lustrous and weatherproof coating.

GF 300 is composed of China wood oil with a small percentage of polymerized linseed oil. Chromate pigments only are used for coloring.

Colors—

GF 300 is made in five colors as follows: Black, Gray, Green, Red and Brown.

Covering Capacity

First Coat	200 sq. ft. per gallon
Second Coat	200 sq. ft. per gallon
Two Coats	100 sq. ft. per gallon

Shipping Data

Shipped in
1-gallon cans
5-gallon drums
30-gallon half-barrels
55-gallon barrels
Shipping Weight 13 lbs. per gallon
Net Weight 11½ lbs. per gallon

SPECIFICATIONS

For Applying GF Steel Coating (GF 300)

1—Material

GF Steel Coating (GF 300), as manufactured by The Genfire Steel Co., Youngstown, Ohio, to be purchased direct from them or their authorized agents and delivered to the work in the original packages. It must be applied without addition or adulteration.

2—Cleaning the Steel

All steel before coating shall be carefully wiped to remove all moisture and oil and then wire brushed to remove all loose scale.

3—Application, Shop Coating

Apply a coating of GF 300, working the compound into all joints and crevices before riveting the parts together. A second coat shall be applied after the steel sides are riveted, and before removal from the shop.

4—Field Coating

After erection, all foreign matter that may have attached itself to the steel during transportation and while laying on the job shall be carefully removed, either by wiping or other means.

After the steel has been cleaned as above specified, all abraded surfaces shall be retouched with GF 300 and the entire surface given a finish coat of GF 300 of the desired color.

GF PROTECTIVE COATING (GF 325)

I Protecting Masonry-Embedded Steel

II Protection Against Certain Acids

When structural steel is to be embedded in concrete or other masonry, the final protective coating can be a less expensive material than the shop coat generally applied. If it covers the steel thoroughly, forms a strong water and alkali-proof film and will expand or contract without cracking, the protection will be sufficient.

GF 325 is a final protective coating to be used over a shop coat such as GF 300. Its constituent parts are fused together at great heat to prevent disintegration by the lime in cement or cement grout and to keep the coating permanently elastic.

The resulting protective film is tough, impervious to water and the alkalies present in green masonry, and will expand and contract with the steel without cracking. It is also a sufficient insulator to prevent disintegration by electrolysis.

Covering Capacity

First coat	200 sq. ft. per gallon
Second coat	200 sq. ft. per gallon
Two coats	approximately 100 sq. ft. per gallon

Shipping Data

Shipped in
1 gallon cans
5 gallon drums
30 gallon half-drums
55 gallon drums

Shipping weight	11 lbs. per gallon
Net weight	9 lbs. per gallon

SPECIFICATIONS

For Applying GF Protective Coating (GF 325)

1—Material

GF Protective Coating (GF 325), manufactured by The Genfire Steel Co., Youngstown, Ohio, must be purchased from the manufacturer direct or from their authorized agents, delivered on the building site in original and sealed packages and applied without adulteration or addition, according to the following instructions:

2—Application

Immediately after erection the steel is to be examined closely to ascertain whether the shop coating has suffered any damage in transportation or erection. If such is the case, re-coat with GF 300 such portions that have been damaged. After allowing this supplementary coating to become thoroughly dry, apply the finishing coat of GF 325, brushing it evenly and thoroughly so that the surface wll be smooth and continuous.

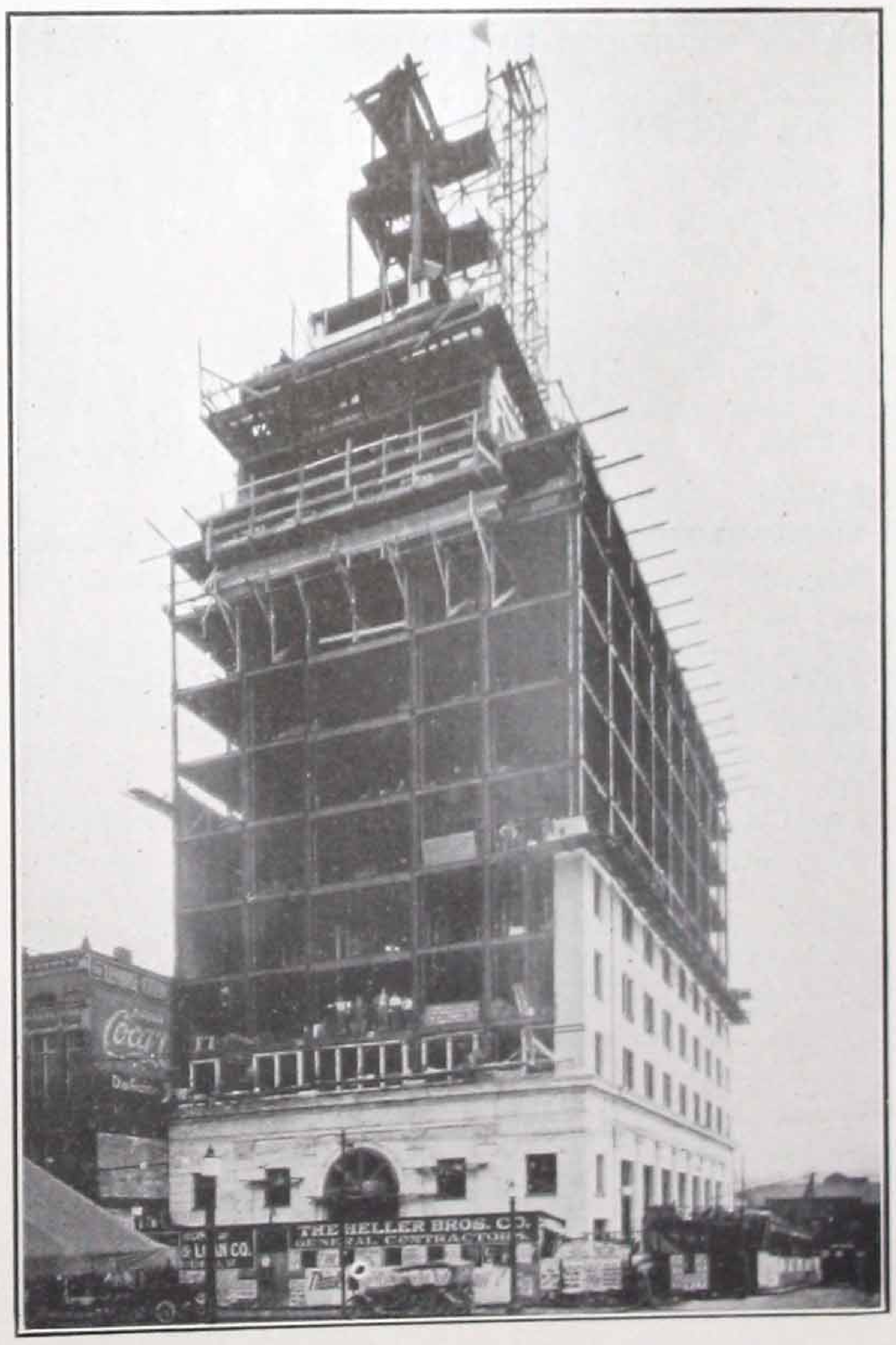
3—Caution

Before the different parts are placed they should be carefully inspected to see that all are thoroughly covered with GF 300.

4—Protection Against Acids

For protection against the following acids, apply two coats of GF 325 after surface has been cleaned of dirt, grease, etc.:

Acetic Acid
Creosote
Garbage
Sewage
Sulphuric Acid
Vinegar



Home Savings and Loan Co., Youngstown, Ohio. GF Protective Coating (GF 325) used for structural Steel. Architect, Charles F. Owsley, Youngstown. Contractors, Heller Bros. Co.

GF GALVANIZED IRON COATING (GF 350)

I Protecting Galvanized Iron, Tin and Zinc

The wide use of galvanized iron, tin and zinc in building has created a demand for a paint or coating which can be used successfully on these materials. The chief difficulty in the past has been the lack of proper adhesion, most paints scaling off after a short time due to a grease-like film formed during the galvanizing process. A coating which does not penetrate this film will soon scale off, while one which destroys the film is injurious to the metal itself.

This difficulty has been overcome by compounding GF 350, in which a strongly adhesive element combines with one which *penetrates the film without destroying it.* This coating adheres firmly to iron, zinc and tin, preventing scaling, and has sufficient elasticity to preclude cracking when the surface to which it is applied expands or contracts. GF 350 dries quickly and sets hard, forming a strong, elastic, rust-preventive covering with exceptional wearing qualities.

GF 350 is used for painting galvanized iron, tin or zinc products, such as gutters and leaders, roofing, siding, etc. It is good practice thoroughly to paint the under side of metal roofing and siding with GF 350 before putting them in place. This is often neglected and as a result causes trouble in later years, for moisture collecting on the under side quickly rusts the unprotected metal. The parts may be coated on the ground before being put in place, so the cost is very little compared to the protection received.

GF 350 is a transparent protective coating, but if a colored finish is desired, GF 350 used as a priming coat affords a thorough bond for any linseed oil or metal paint and prevents cracking and peeling of the finish.

Covering Capacity

First coat	275 sq. ft. per gallon
Second coat	325 sq. ft. per gallon
Two coats	150 sq. ft. per gallon

Labor Cost

One man can apply 5 gallons per day, or it can be applied with a spray.

Shipped in

1 gallon cans
5 gallon drums
30 gallon half-drums
55 gallon drums

Shipping weight	9 lbs. per gallon
Net weight	7½ lbs. per gallon

SPECIFICATIONS

For Applying GF Galvanized Iron Coating (GF 350)

1—Material

GF Galvanized Iron Coating (GF 350) as manufactured by The Genfire Steel Co., Youngstown, Ohio, is to be purchased direct from them or their authorized agents and brought to the building site in original packages and applied without addition or adulteration.

2—Preparing Surfaces

Before any coating is applied the surface of the metal shall be cleaned of all particles of foreign matter, such as mortar, plaster, other kinds of paints, etc., washed with benzine and shall be absolutely dry.

3—Application

After the foregoing conditions have been complied with, a thorough covering coat of GF 350 is to be applied. The coating must be thoroughly worked into all seams and joints and around all rivet heads.

When the GF 350 coat has cured for 24 hours, a second coat of any desired shade of GF 300, linseed oil or metal paint may be applied in the same careful manner.

4—Back Coating

Before erecting, all sheets for roofing, siding, etc., shall be thoroughly coated on the back or unexposed face with 1 coat of GF 350 applied in accordance with Paragraph 3.

GF BONDING COMPOUND (GF 400)

I Bonding New Concrete to Old
II Patching Cement Floors, etc.

The problem of bonding new concrete to old occurs both in repairing or adding to old concrete, and on new construction where each day's work must be joined to the next. In applying waterproof cement mortar, and when laying floor finish over a set up concrete or cement surface, perfect adhesion is indispensable for effective work and depends upon the solidity of bond.

Old surfaces may be prepared for bonding by such mechanical means as scouring, hacking and wire-brushing, but these methods usually are insufficient for they do not always expose the aggregate. The real obstacle to a perfect joint is a thin, glassy cement film which forms on the surface of concrete and sets with particles of dust and dirt firmly embedded in it. To secure a dependable bond, this hard film and all foreign substances must be removed from the old surface so that the aggregates are exposed for active union with the new concrete.

GF 400 is a powerful acid powder to be dissolved in water and applied to the surface of the concrete. It effervesces immediately, removing the film and all foreign material and exposing the aggregate of the concrete ready for joining with the new work.

In preparing GF 400, every precaution has been taken to prevent injuring the strength or durability of the concrete to which it is applied. Tests show that concrete bonded together in this way and tested to destruction, breaks more quickly at any other point than at the point of joining.

Treatment of an old or set up concrete or cement surface with GF 400 Bonding Compound will give a bond of 80 lbs. per square inch of surface between the old surface and the new work.

This is especially valuable in waterproofing work, as it will bond new and old concrete perfectly, making it absolutely monolithic. In the case of Portland cement plaster coat waterproofing, applied to the interior of a basement to waterproof against pressure from the outside, it will bond the new work to the old construction so that it will resist a water pressure of 11,520 lbs. per square foot of surface, which is equivalent to 184 feet of hydrostatic pressure.

When applied to the surface of concrete arches, or over an old cement floor, GF 400 will give a perfect monolithic bond between the new topping and the old surface.

A monolithic bond for lime or gypsum plaster to concrete wall or ceiling surface is obtained by chipping, wire brushing and using GF 400 Bonding Compound.

GF 400 is put up in five-pound jars packed 6 to the case. Two pounds dissolved in one gallon of water will treat from 100 to 150 square feet of surface, varying according to the porosity of the surface.

(Note—After the GF 400 has completed its chemical action it must be removed carefully so that none remains or comes in contact with the new work.)

SPECIFICATIONS

For Use of GF Bonding Compound (GF 400)

1—Material

The Bonding Compound used for all work shall be GF Bonding Compound (GF 400), manufactured by The Genfire Stee Co., Youngstown, Ohio, purchased direct from them or their authorized agents. It shall be brought to the building site in original packages and applied according to the manufacturer's directions.

2—Preparing Surfaces

Surfaces to be treated with the Bonding Compound shall be roughened thoroughly all over with a mason's chipping hammer, then cleaned with a wire brush to remove all loose particles.

3—Mixing GF 400

GF 400 is to be dissolved in water in the proportion of 2 lbs. of GF 400 in 1 gallon of water, stirred until it is dissolved thoroughly.

4—Application

A liberal coat of GF 400 in solution shall be applied to the rough surface, using either a broom or an acid brush. This to remain until all effervescence and chemical action have ceased.

If the first application does not completely clean the surface and expose all aggregates, apply a second coating in the same manner.

5—Washing

Immediately after GF 400 has exhausted itself (after chemical action has stopped) wash down the surface by several applications of clean water, and when the surface is saturated thoroughly by this means to a point where it will absorb no more water apply a thin cream of cement and water. Before this cream of cement and water sets and becomes hard, join on the new concrete.

(Note—If a hose is available for washing down the wall or floor this affords the best means of cleaning and saturating).

GF TIMBER PRESERVATIVE (GF 550)

I Protecting Timbers Embedded In Masonry Or Earth

Because of the rapidly diminishing forest reserves throughout the world, especially of the hardwoods and others especially suitable for use in building construction, and the consequent rapidly increasing cost of lumber, methods of prolonging the life of this very necessary construction material deserve very serious consideration.

The reserves or saps of all woods, used in any kind of building construction, rot away, dry out and are destroyed. These saps are the natural glues which bind the fibers together and impart strength and hardness to the wood.

When the sap disappears the fibers of the wood separate causing splinters, peeling away of the surface and disintegration which gradually extends throughout the thickness of the wood.

The destruction of the sap is greatly hastened by exposure to the air, to alternating hot and cold or wet and dry conditions, to the penetration of water, soaps, alkalies, oils, and chemicals, and also by the attacks of insects, parasites, and fungi which propagate freely in damp and warm surroundings.

To increase the durability of any kind of wood it is necessary to supply that which nature has omitted by putting into the pores of the wood a compound that will take the place of the sap that may be lacking, prevent the decay of that which already exists and protect it from the attacks of the destructive agencies mentioned.

A product for this purpose should, preferably, be of the same nature as the saps themselves so that it can enter into combination with and become an integral part of that which it is to protect and at the same time be immune to the attacks of all agencies that destroy sap.

Creosote, consisting of phenols and their esters derived from the distillation of various wood saps, is an excellent substitute for and preservative of the sap of any kind of wood.

Phenol is a powerful caustic poison and the esters are the compounds formed by the changing of the hydrogen of such into hydro-carbons.

Creosote combines intimately with the sap and, by its antiseptic properties, serves to protect it against all destructive agencies except parasitic and fungi life, against which it affords but slight protection, being a poor germicide.

Treating timber with creosote also serves to make it fireproof. Tests conducted by Dr. Hermann von Schrenk of St. Louis, some years ago, proved that timber treated with creosote required about 2½ times as long to ignite as untreated timber, and after ignition burned only about 10 minutes before going out, while untreated timber burned to ashes.

Creosote is excellent for preserving structural timbers exposed to the weather or embedded in earth or masonry, but on account of its odor and the very dark brown color it gives the wood is not desirable for general use.

GF TIMBER PRESERVATIVE (GF 550)

GF 550 Timber Preservative is composed of creosote with a certain percentage of zinc salts and copper, added, to make it a perfect germicide against all forms of germ life, the latter adding just the necessary elements that creosote in itself lacks.

GF 550 is intended for use on any kind of structural timbers exposed to the weather or embedded in earth or masonry or in contact with same, where appearance and color is not a vital factor.

GF 550 can be applied cold with a brush on small work. On large work it is cheaper to use the dipping process, heating the GF 550 in a tank, to about 120° Fahr.

Covering Capacity

100 square feet of surface per gallon on rough surfaces.
200 square feet of surface per gallon on smooth surfaces.
350 square feet of surface per gallon on dipped surfaces and brushed.

Labor Cost

One man can apply four gallons per day.

Shipped In

55 gallon drums.
30 gallon half drums.
5 gallon drums.
1 gallon cans.
Shipping weight 8½ lbs. per gallon.

SPECIFICATIONS FOR APPLYING GF TIMBER PRESERVATIVE (GF 550)

1—Application

All timbers embedded in masonry, all sills, ends of beams in brick or concrete walls, beams and sleepers of wood floors laid upon earth, shingles or siding shall receive a good brush coating of GF timber Preservative (GF 550), care to be taken that all surfaces are thoroughly and evenly coated. GF 550 can also be effectively applied by means of a spray or by dipping.

HANDY DATA FOR COMPUTING AREAS AND QUANTITIES

Cubic Measurements

1728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard
231 cubic inches = 1 gallon
1 cubic foot = 7½ gallons
1 cubic foot water = 62½ lbs.

To find Areas

D = long diameter
d = short diameter
H = height
L = length
W = width
P = perimeter

Wall or floor surface	L x W
Circular floor surface	D^2 x .786
Perimeter of circular tank	D x 3.1416
Walls of circular tank	P x H
Elliptic floor surface	D x d x .7854

Perimeter of elliptic tank

$$3.1416\sqrt{\frac{D^2+d^2}{2} - \frac{(D-d)^2}{8.8}}$$

Walls of elliptic tank	P x H
Surface of Cylinder	(D x H x 3.1416) + (D^2 x 1.5708)
Surface of sphere	D^3 x .5236
Surface of cone	(R x H x 3.1416) + (R^2 x 3.1416)

To find capacity in gallons

Square or Rectangular tank	L x W x H x 7.5
Circular tank	D^2 x H x 5.88
Elliptic tank	D x d x H x 5.89
Sphere	R^2 x 94.25
Cone	D^2 x H x 1.97
Barrel	$(D \text{ at head} + D \text{ at bung})^2$ x L x .0008

Above are inside measurements, in feet, except for barrel, which are in inches.

To find capacity in cubic feet

Any of above — Divide results obtained as above by 7.5

APPROXIMATE QUANTITIES OF MATERIALS REQUIRED

PROPORTIONS

CONCRETE

	1:2:4						1:2½:5					
Thickness	Bags Cement	Cu. yd. Sand	Cu. yd. Stone	Gal. Water	Lbs. GF 10	Lbs. GF 11	Bags Cement	Cu. yd. Sand	Cu. yd. Stone	Gal. Water	Lbs. GF 10	Lbs. GF 11
1 cubic yard	6	.45	.89	35	8	12	5	.46	.92	35	8	10
100 sq. ft. 2"	3.75	.27	.54	22.5	5	7.5	3	.28	.57	21	4	6
100 sq. ft. 2½"	4.64	.34	.68	28	6.25	9.5	3.84	.36	.72	27	5.25	7.5
100 sq. ft. 3"	5.6	.41	.82	33.5	7.5	11	4.6	.43	.86	32	6	9
100 sq. ft. 3½"	6.5	.47	.95	39	8.75	13	5.36	.50	1.00	37.5	7.25	10.75
100 sq. ft. 4"	7.5	.54	1.00	45	10	15	6.12	.57	1.14	43	8.25	12.25
100 sq. ft. 4½"	8.3	.61	1.22	50	11	16.5	6.88	.64	1.28	48	9.25	13.75
100 sq. ft. 5"	9.3	.68	1.36	56	12.5	18.5	7.64	.71	1.42	53.5	10.25	15.25
100 sq. ft. 6"	11.2	.82	1.64	67	15	22.5	9	.86	1.72	63	12	18

When cinders are used in place of stone the mixture will require about 10% more sand and 10% more water than shown above.

When ashes are used in place of stone the mixture will require about 10% less sand than shown above.

When slag is used in place of stone the mixture will require about 10% more sand and about 30% more water than shown above. It is better to put this *additional* water into the slag itself by spraying previous to placing the slag into the mixer.

PORTLAND CEMENT PLASTER, STUCCO, FLOOR TOPPING, AND MORTAR

PROPORTIONS

	1:2½						1:3					
Thickness	Bags Cement	Cu. yd. Sand	Bushel Hair	Gal. Water	Lbs. GF 10	Lbs. GF 11	Bags Cement	Cu. yd. Sand	Bushel Hair	Gal. Water	Lbs. GF 10	Lbs. GF 11
100 sq. ft. ⅜"	1.3	.12	.16	4	1.75	2.5	1.1	.13	.14	3.5	1.5	2.25
100 sq. ft. ⅝"	1.7	.16	.21	5	2.25	3.5	1.5	.17	.19	4.5	2	3
100 sq. ft. ¾"	2.5	.23	.31	7.5	3.5	5	2.2	.25	.28	6.5	3	4.5
100 sq. ft. 1"	3.3	.31	.41	10	4.5	6.5	3	.33	.38	9	4	6
100 sq. ft. 1¼"	4.2	.39	.53	12.5	5.5	8.5	3.7	.41	.46	11	5	7.5
100 sq. ft. 1½"	5.1	.47	.64	15.25	7	10.25	4.5	.50	.56	13.5	6	9
100 sq. ft. 1¾"	6	.56	.75	18	8	12	5.4	.60	.68	16	7	11
100 sq. ft. 2"	6.9	.64	.86	20.25	9.25	14	6.2	.69	.78	18.5	8	12.5

We do not recommend richer proportions than 1:2:4 for concrete and 1:2½ for any kind of work made with Portland Cement.

The reason is that if more cement is used the modulus of elasticity of the mass is overbalanced by the cement, resulting in hair checking and crazing of the surface.

BRICKWORK

		Portland Cement					Hydrated Lime		
	8¼ x 4 x 2¼ Bricks	Bags Cement	Cu. yd. Sand	Gal. Water	Lbs. GF 10	Lbs. GF 11	Lbs. Lime	Cu. yd. Sand	Gal. Water
50 cu. ft. with ⅜" joints	1000	4	.37	12	5.5	8	150	.5	15
50 cu. ft. with ⅛" joints	1100	1.3	.12	4	1.8	3	50	.2	5

REINFORCED CONCRETE SLABS

For Walls—Horizontal Water Pressure

Table No. 1

Reinforced Concrete Slabs for Walls

Safe Loads in Pounds per square foot

Stress in Concrete 640 lbs. per sq. in.
Stress in Steel 16,000 lbs. per sq. in.
% of Steel = .0075 BM. = $\frac{WL}{10}$
CLEAR SPAN IN FEET

Total Thickness of Slab		4″	5″	6″	7″	8″	9″	10″	11″	12″	13″	14″	15″	16″	
Effective Depth of Slab		3″	4″	5″	6″	6½″	7½″	8″	9″	10″	11″	12″	13″	14″	
	3	1050	1865	2910	4210	4940	6580	7480							3
	4	591	1050	1620	2360	2780	3690	4200							4
	5	377	670	1050	1510	1775	2350	2680	3400	4200					5
	6	262	467	730	1050	1230	1640	1865	2360	2920					6
	7	193	344	535	770	905	1205	1370	1740	2140	2590	3080			7
	8	148	262	410	590	695	923	1050	1330	1640	1990	2360	2770	3220	8
	9	116	207	324	467	547	730	830	1050	1295	1570	1870	2200	540	9
	10		168	262	377	447	590	670	850	1050	1270	1510	1780	2060	10
	11		139	216	312	365	486	555	702	870	1050	1245	1465	1700	11
	12			182	262	306	408	465	590	728	885	1050	1215	1420	12
	13			154	222	261	348	395	500	620	750	890	1050	1220	13
	14			134	193	226	300	342	433	535	650	770	905	1050	14
	15				167	196	262	298	377	465	565	670	790	915	15
	16				147	173	230	262	332	408	495	590	692	802	16
	17				130	153	203	232	294	363	440	520	615	710	17
	18					136	181	206	261	323	391	465	545	635	18
	19						162	185	235	290	350	417	490	568	19
	20							168	212	262	318	378	445	515	20
Weight of Slab per sq. foot		50	63	75	88	100	113	125	138	150	163	175	187	200	
Area of Steel per foot width		.27	.36	.45	.54	.585	.675	.72	.81	.90	.99	1.079	1.17	1.26	

The table of Reinforced Concrete Slabs for Walls (Table 1), is a table of Total Loads per square foot that can be safely resisted by slabs of various spans and thicknesses with different amounts of steel reinforcement. It is used in the design of walls, constructed as reinforced concrete slabs with vertical supports (or buttresses) at stated intervals, and in which the reinforcement runs horizontally between supports.

To illustrate the use of this table we will consider as a slab a section of wall having vertical supports 12′ apart and on the other side of the wall—water 10′ deep.

It is evident that the pressure against this wall varies from a maximum at the bottom, or deepest point, to nothing at the top. Consequently, the wall must be strong enough to resist the maximum pressure at the bottom and the strength may be gradually decreased toward the top. If the wall is considered as made up of successive horizontal layers or laminations one foot deep and each layer designed to resist the pressure of the water at that depth, the result will be a design that is safe and economical.

Consider first the bottom layer, 1 foot high. The mean depth of water on the face of this layer is 9½′. The pressure of the water is 9½ x 62½ = 593¾ pounds and the bottom section must therefore be designed to resist that pressure.

In Table 1 find the span 12 feet (the distance between supports) in the column headed "Clear Span in Feet." Opposite this on the same horizontal line, we find under the vertical column "Total Thickness of Slab" that an 11″ slab has a strength of 590 pounds per square foot and while the actual pressure exerted is about 4 pounds greater than this, we can use this slab with safety.

In the same vertical column opposite "Area of Steel per Foot of Width" we find that .81 square inches of reinforcing steel is required per foot width of slab. And opposite "Effective Depth of Slab" we find that this steel must be placed 9″ from the water face of the wall.

The proper design is a wall built up after the manner described for the bottom layer, considering the exact water pressure to which each layer or step is subjected, and in foundations for buildings, the weight of the superstructure it must support. For all practical purposes in connection with small work, however, the usual method is to design the wall of a uniform thickness sufficient to take the maximum pressure.

Position of Reinforcing Steel

In reinforced concrete slabs the reinforcing steel is placed to resist tension stresses—and the concrete, which is weak in tension, is designed to resist compression stresses.

Where concrete walls are used to resist water pressure and the walls are of simple design, having horizontal reinforcement only, the reinforcing steel is placed near the surface on the side opposite the water pressure.

In the floors of a building the loads are placed upon the upper surface of the slabs and the reinforcing steel is placed near the under side of the slab. In the case of basement floors, however, designed to resist water pressure from beneath, the position of the reinforcing steel is reversed, i. e., it is placed near the top of the slab.

To find the pressure exerted by a given head of water, multiply the head in feet by 62.5 pounds. Thus, a 10-foot head of water will exert a pressure of 625 pounds per square foot.

A ready method of determining the necessary thickness of concrete required to withstand a given water pressure is to divide the depth or height of the water above the under side of the floor slab, in inches, by 2.3, which will give, in inches, the requisite thickness of concrete. In cases where this shows more than 12″ of concrete to be necessary it is more economical to use reinforced concrete.

REINFORCED CONCRETE SLABS

For Floors—Upward Water Pressure

Table No. 2

Reinforced Concrete Slabs for Floors
Safe Loads in Pounds per square foot

Stress in Concrete 640 lbs. per sq. in.
Stress in Steel 16,000 lbs. per sq. in.
% of Steel = .0075 BM. = $\frac{WL}{10}$

CLEAR SPAN IN FEET	4″	5″	6″	7″	8″	9″	10″	11″	12″	13″	14″	15″	16″	
Total Thickness of Slab	4″	5″	6″	7″	8″	9″	10″	11″	12″	13″	14″	15″	16″	
Effective Depth of Slab	3″	4″	5″	6″	6½″	7½″	8″	9″	10″	11″	12″	13″	14″	
3	1100	1928	2985	4298	5040	6693	7605							3
4	642	1113	1695	2448	2880	3803	4325							4
5	427	733	1125	1598	1875	2463	2805	3538	4350					5
6	312	530	805	1138	1330	1753	1990	2498	3070					6
7	243	407	610	858	1005	1318	1495	1878	2290	2753	3255			7
8	198	325	485	678	795	1036	1175	1468	1790	2153	2535	2957	3420	8
9	166	270	399	555	647	843	955	1188	1445	1733	2045	2387	2740	9
10		231	337	465	545	703	795	988	1200	1433	1685	1967	2260	10
11		202	291	400	465	599	680	840	1020	1213	1420	1652	1900	11
12			257	350	406	521	590	728	878	1048	1225	1402	1620	12
13			229	310	361	461	520	638	770	913	1065	1237	1420	13
14			209	281	326	413	467	571	685	813	945	1092	1250	14
15				255	296	375	423	515	615	728	845	977	1115	15
16				235	273	343	387	470	558	658	765	879	1002	16
17				218	253	316	357	432	513	603	695	802	910	17
18					236	294	331	399	473	554	640	732	835	18
19						275	310	373	440	513	592	677	768	19
20							293	350	412	481	553	632	715	20
Weight of Slab per sq. foot	50	63	75	88	100	113	125	138	150	163	175	187	200	
Area of Steel per foot width	.27	.36	.45	.54	.585	.675	.72	.81	.90	.99	1.079	1.17	1.26	

In reinforcing floors against a water pressure, the reinforcing steel *must be placed near the top of the slab.*

The table of Reinforced Concrete Slabs for Floors (Table 2) shows the total thickness of slab, the amount of reinforcing steel required and the distance from the water face of the slab to the center of the reinforcing. It considers reinforcing as placed in one direction only.

To illustrate, we will take the case of a floor slab with supports 15′ apart, subjected to a pressure caused by a 7′ head of water. The pressure, or in this case, the lifting power of the water, is 7 x 62½ = 437½ pounds per square foot.

Find the span 15′ in the column "Clear Span in Feet" on Table 2. Opposite this and on the same horizontal line we find under the column "Total Thickness of Slab" that an 11″ slab will resist a water pressure of 515 pounds per square foot, while the actual lifting power of a 7′ column of water is only 437½ pounds per square foot.

In the same vertical column opposite "Area of Steel per Foot of Width" we find that .81 square inches of reinforcing steel is required per foot width of slab. And opposite "Effective Depth of Slab" we find that this steel must be placed 9″ from the bottom face of the slab.

As the water pressure is the same over the entire floor, the thickness of the slab and the amount of reinforcing steel will be the same at every point.

The safe pressure loads, given in Table 2, include the weight of the slab.

AVERAGE WEIGHTS OF BUILDING MATERIALS PER CUBIC FOOT

Ashes	30 lbs.
Brick pressed	150 lbs.
Brick common	125 lbs.
Brickwork pressed	140 lbs.
Brickwork common	120 lbs.
Cement Portland 1 bag	94 lbs.
Cinders	45 lbs.
Concrete Cinder	110 lbs.
Concrete Stone or Gravel	144 lbs.
Concrete Stone or Gravel (reinforced)	150 lbs.
Earth loose	76 lbs.
Earth rammed	100 lbs.
Granite	170 lbs.
Gravel	100 lbs.
Gravel wet	115 lbs.
Gypsum	142 lbs.
Lime	75 lbs.
Mortar, lime	105 lbs.
Mortar Portland Cement	135 lbs.
Mud	100 lbs.
Rock	100 lbs.
Sand, dry	90 lbs.
Sand, wet	115 lbs.
Stone, broken	95 lbs.
Water fresh	62½ lbs.
Water salt	64 lbs.
Cement floor finish 1″ thick per square foot	12 lbs.
Cement plaster coat ¾″ thick per square foot	8 lbs.

The Genfire Line of Popular Firesafe Building Products

Herringbone Doublemesh
The smallest mesh metal lath made, forming a perfect key, and having unusual strength and rigidity.

Herringbone Metal Lath
Rigidity, fire-resistance and simplicity of erection have made Herringbone lath popular, especially for stucco work.

Diamond Rib Lath
Especially adapted to maximum spacing of joists and studding, its longitudinal ribs giving maximum rigidity between supports.

Key Expanded Metal Lath
For lathing domes, wrapping beams and columns and for ornamental plastering. The mesh is pliable and lends itself to odd formations.

Genfire Sheet Lath
A sheet steel lath which has its greatest feature in plaster economy, requiring an absolute minimum of plaster.

Self-Sentering
A combined form and reinforcement for floors and roofs, a one-piece metal lath and stud, a composite lath and furring.

Trussit
An expanded steel reinforcement especially designed for solid partitions, side-walls and other vertical construction.

Genfire Steel Tile
For labor saving and economy in floor and ceiling construction, used as steel forms for concrete slabs.

Genfire Expanded Metal
Made in a variety of weights and meshes, the larger meshes are used for reinforcing concrete for floors, roofs, bridges, sewers, etc., the smaller for machinery guards, elevators and tool room enclosures, etc.

T Bar Joists
The demand for bar joist construction has developed the Genfire T Bar Joist with its many distinctive features found in no other.

Genfire Plate Girder Joists
The Genfire Plate Girder Joist offers many advantages for light occupancy buildings where open web and maximum headroom are not required.

Genfire Cold Rolled Channels
For use as a furring on suspended ceilings, false beams, columns, or cornice work on masonry walls and for metal lath partitions.

Genfire Corner Bead Winged Type
Used largely for residential work over wood or metal lath when protection with economy is desired.

Genfire Expanded Corner Bead
Protects plastered corners from severe impact and reinforces the plaster a safe distance back from the corner.

Duplex Steel Bridging
Carpenters find this bridging handier, more compact and easier to install than wood bridging. It also costs less for the finished job.

Genfire Double Channel Joist
The Genfire Double Channel Joist is a small, light weight joist, cold rolled from two identical sections and electrically welded.

Genfire Casement and Basement Windows
Are weathertight, open and close easily, never stick, warp or get out of line, they are a highly developed product with many distinctive features.

Genfire Pivoted Steel Windows
Delivered ready for installation, simple of erection, they are built into the wall, are rigid and solid and will last indefinitely.

Genfire Steel Lintels
Durable and rust resisting, give a rigid support for all openings, are superior to any other for economy and permanence.

Genfire Industrial Steel Doors
Where doors must stand hard usage, Genfire Industrial Steel Doors are economical, useful, convenient and safe.

Genfire Wire Mesh
The most popular type of concrete road reinforcement. Manufactured with absolutely rigid joints.

Genfire Road Forms
Embody many outstanding improvements, simplicity saves time in placing, sliding connections provide perfect alignment.

Genfire Curb Bars
For protecting the upper outside corner of concreted curbing, they are more wear resisting than the hardest concrete.

Genfire Edge Protector
All exposed corners of concrete work, columns, steps and interior work should be protected with Genfire Edge Protectors.

Literature Free on Request

GENFIRE STEEL COMPANY

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